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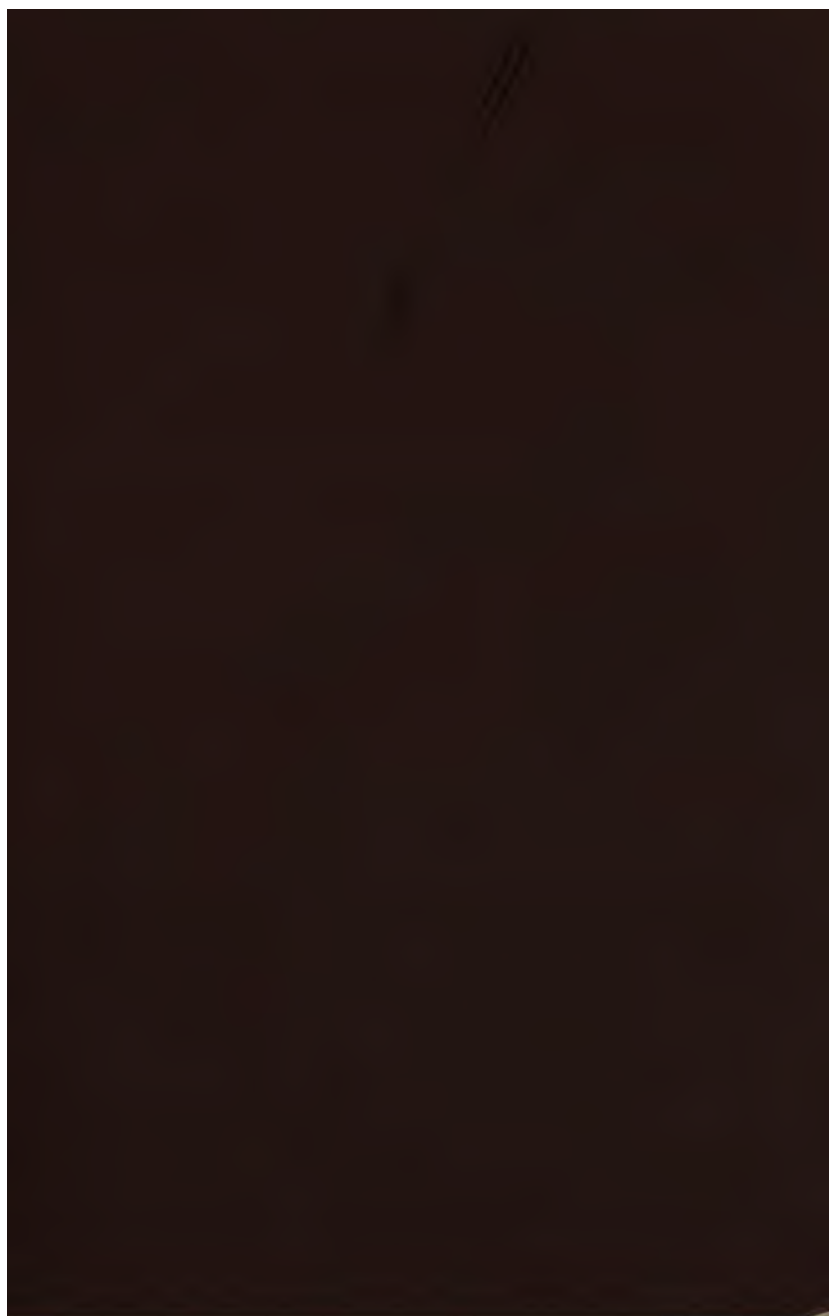
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THE
CURE OF RUPTURE

REDUCIBLE AND IRREDUCIBLE,

ALSO OF

VARICOCELE AND HYDROCELE,

BY NEW METHODS.

BY

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"From circumstances which have come to my knowledge, I think it possible that something more than is yet generally known may be done for persons afflicted with hernia."

SIR WILLIAM FERGUSSON, Bart.,
(*Alluding to the operation to be described in this volume*)
PRACTICAL SURGERY, Eng. Ed., p. 738.

PREFACE.

IN the following pages I offer to the profession some of the results of a life devoted to the study and relief of hernia and kindred diseases. Hernia is a subject which has engaged the earnest attention of many able minds, but heretofore without great practical advance towards a permanent cure of the malady. The belief that this desirable result has at last been attained, now that sufficient time has been taken to test the reality of the cures, is the chief motive for this publication.

I intended to have published a volume on this subject in connection with my only son, Dr. Charles W. Heaton, but his premature death, in 1868, from disease contracted in the U. S. Army during our late war, prevented the fulfillment of my long cherished wishes.

GEORGE HEATON.

586 TREMONT ST., BOSTON, U. S. A., *May*, 1877.

EDITOR'S PREFACE.

DURING the summer of 1875, I was requested by Dr. Heaton to prepare, in connection with him, a paper describing the method of curing hernia which he has practiced for so many years in Boston. At first this seemed an easy task, but I soon began to realize how difficult it may be to elucidate the doctrines of another, — doctrines too so different in many respects from the prevalent ideas on this subject.

In fact, the preparation of the present volume, necessitating the personal observation of many cases, has required a longer time than was anticipated. Even further delay might prove advantageous for the perfection of the work, but the importance of the subject, and the general interest always manifested in it, override any such personal considerations in an attempt to advance the cause of science.

J. H. D.

ROXBURY, BOSTON, *May*, 1877

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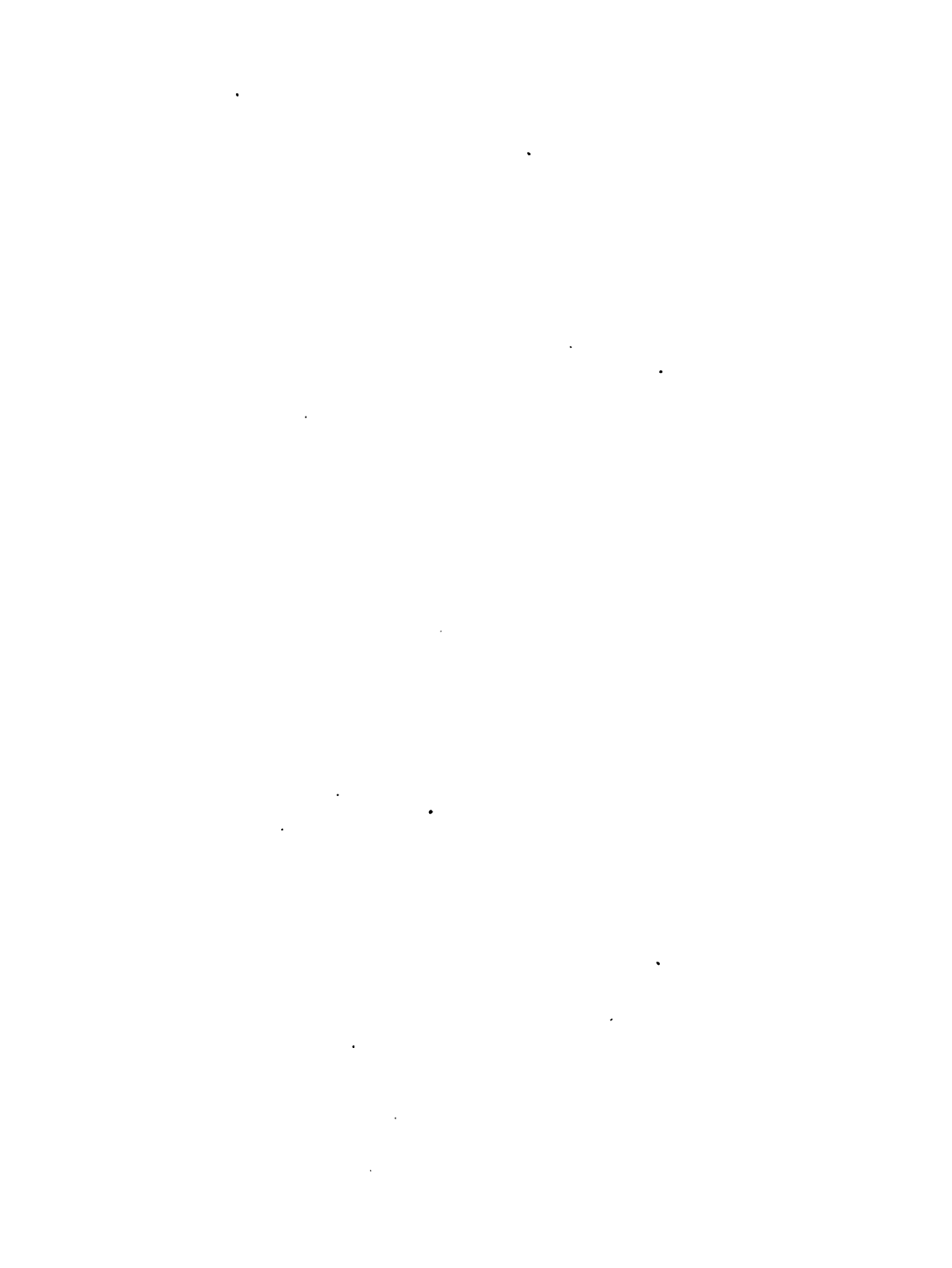
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THE CURE OF RUPTURE.

CHAPTER I.

ABDOMINAL HERNIA.

THE word hernia is probably derived from the Greek *ἔρως*, a shoot or scion, and technically means the escape of any viscus from the cavity in which it is naturally contained. The word rupture has become the synonym of hernia; both in scientific and in popular use. As, however, protrusions from any cavity except the abdomen are very rare, either word, unless otherwise qualified, may be always considered to mean abdominal hernia or rupture, and it is in this sense alone that it will be employed in the following pages.

There are no portions of the abdominal parietes, except those which are formed by bone, which may not be deficient from congenital malformation, and thus allow the contained viscera to

escape. But it is most usual for hernia to appear at the anterior abdominal wall, protruding through natural openings which exist for the passage of vessels, or through muscular and tendinous fibres which from disease or other cause are unnaturally weak.

The following are the different varieties of hernia; they are named from the situations at which they occur.

I. *Inguinal*. Of this variety there are several forms. The most common, which is called external or oblique, appears first at the internal abdominal ring, and, after traversing the inguinal canal, emerges at the external ring and thence descends into the scrotum in the male and into the labium pudendi in the female. It follows the course of the spermatic cord in one sex and of the round ligament of the uterus in the other.

The internal or direct inguinal hernia distends the parts immediately behind the external ring and descends through it to the scrotum or labium. Congenital and encysted herniæ are peculiar forms of the oblique variety.

II. *Femoral or Crural*. This variety passes under the crural arch, enters the crural canal, and appears at the upper and inner part of the thigh.

III. *Umbilical*. This hernia appears at the navel, passing through the opening which in the fœtus served to transmit the umbilical vessels.

IV. *Ventral*. The linea alba, the lineæ semi-lunares and transversæ, and in fact the whole anterior wall of the abdomen, are penetrated by openings which transmit vessels and nerves from the deeper-seated parts to the integument. Any one of these apertures, when unnaturally large and relaxed, may become the seat of a hernia.

V. *Perineal*. A hernia may descend between the rectum and the bladder in the male, or rectum and uterus and vagina in the female, and form a tumor in the perinæum.

VI. *Vaginal*. This is a variety of the preceding, in which the tumor, instead of passing on between the rectum and vagina to the perinæum, protrudes into the vagina and blocks up its passage more or less. Sir Astley Cooper states that in a hernia of this description, which he saw, there was a considerable external tumor when the bladder was full that disappeared when it was emptied.

VII. *Pudendal*. In this variety the hernia descends as in the two preceding, but instead of

appearing in the perinæum or vagina passes into the labium pudendi.

VIII. *Obturator or Thyroid*. This hernia passes through the opening in the obturator membrane which transmits the obturator vessels and nerve. It never forms a tumor which can be perceived previous to dissection.

IX. *Ischiatic*. This variety passes out by the ischiatic notch ; its tumor, which is small and by the side of the sciatic nerve, is covered by the glutæi muscles.

X. *Diaphragmatic*. The viscera of the abdomen sometimes make their way through the diaphragm into the pleural cavity. The opening through which they pass is usually caused by congenital malformation and exists most commonly in the muscular fibres of the diaphragm, rarely in the tendinous portion ; they may also pass through the openings which transmit the œsophagus, vena cava, and aorta.

Although the above varieties of hernia have all been occasionally observed, and should therefore be described in works which claim to treat the subject of hernia thoroughly, they are, with the exception of the first three, so very rare that the

slight mention of them already made is ordinarily sufficient.

Unnatural openings sometimes exist in the mesentery and mesocolon which may permit the intestines or other viscera to pass between their layers and become strangulated. Inflammation also sometimes gives rise to bands of lymph which may produce strangulation. The lesions produced by these causes, although frequently denominated internal herniæ, are not so, strictly speaking, for in none of them does the contained viscus escape from its natural cavity.

Of the preceding varieties of hernia the three first mentioned, namely, inguinal, crural, and umbilical, are by far the most frequently encountered in practice, and the method of cure to be advocated in these pages is applicable most especially to these forms of hernia.

Pathology of Hernia. The peritoneum is a serous membrane lining the entire internal surface of the abdominal walls, and forming an external covering for most of the contained viscera. By furnishing the abdominal walls and their contents with a perfectly smooth and moist surface, it facilitates the necessary movements of the lat-

ter, and aids in keeping them in place and preventing protrusion.

As the greater part of the abdominal viscera are covered by the peritoneum, it usually happens in the formation of a hernia that this membrane either is ruptured by the protruding viscus, or advances before it. The early surgeons believed the first of these results took place, — hence the term “*rupture*.” More modern investigations, however, have shown that true rupture of the peritoneum very rarely occurs; that this membrane, being capable of almost unlimited distention, surrounds the hernia, forming what is known as its *sac*. Moreover, distention is not the only change which the peritoneum undergoes in forming a hernial sac. In other parts of the body we see that tissues when subjected to great and constant pressure become attenuated and absorbed; but if subjected to a less constant and slighter degree of pressure, that instead of growing thinner they increase in thickness. Like changes take place in the peritoneum in the event of hernia. If the distending force is very great, the hernial sac may become exceedingly thin, or even be absorbed. This condition obtains frequently in umbilical hernia,

though partly due to another cause. If, on the other hand, the pressure is more gradual, the peritoneum may become so thickened as to lose much of its original appearance, and under the microscope be found somewhat deficient in its yellow elastic fibres.

To the linea alba and sheath of the recti muscles the peritoneum is firmly and almost inseparably attached, while to the remainder of the abdominal walls it is united only by a loose cellular tissue arranged in such a manner as to allow a considerable degree of displacement of the membrane without rupture of the connecting medium. When a hernia has descended, this cellular tissue surrounding the sac quickly contracts adhesions to the neighboring parts. While a hernia is still of recent origin, if its contents be reduced, that is to say, returned to the abdomen, these adhesions can be broken up and the hernial sac also be returned with the viscera. But after a certain lapse of time the vascular supply of the sac, which at first retained its connection with the general peritoneal circulation, becomes connected with the parts adjacent to the hernia, the areolar adhesions also become stronger, and then the returning of the

sac, upon the reduction of the hernia, becomes difficult, if not impracticable.

With the exception of the duodenum and the pancreas, which are firmly attached to the spine, all the different abdominal viscera have been found in hernia. Those which are most commonly protruded are the omentum and the ileum, next the colon and cæcum. As the cæcum and the bladder are but partially covered by peritoneum, these viscera may be but partially covered, if at all, by the hernial sac.

Herniæ are often named from the viscera which they contain. Thus an omental hernia is termed epiplocele; one with intestine, enterocele; and so on.

Herniæ may be either reducible, irreducible, strangulated, or incarcerated. A reducible hernia is one in which the contents of the sac can be returned to the abdomen. In an irreducible hernia the contents cannot be returned, but the functions of the protruded parts are still performed with more or less regularity. Strangulation is the most dangerous condition of hernia. It is due to a stricture of the protrusion which causes active interference with the functions of the viscera or

with their circulation. The treatment to remove the cause of stricture should be early, if not immediate. Incarceration is a term which writers have used with different meanings. As the bowel contained in a hernial tumor is deprived of that assistance to the performance of its functions which it receives in its normal situation from the support and pressure of the respiratory muscles, it not infrequently happens that its contents become arrested in their passage through the intestine, producing the condition known as obstruction or incarceration. If this obstruction is not removed, it goes on from bad to worse, the circulation becomes affected, inflammation sets in, and the incarceration becomes a strangulation. A similar, though less imminent risk, exists in all varieties of irreducible herniæ.

Etiology. The causes of hernia are either predisposing or exciting. The first class includes all those conditions which produce a weakness of the abdominal walls, such as congenital malformation; a natural weakness or laxity of fibre, apt to be inherited; the distention of the abdomen produced by obesity, pregnancy, dropsy, and diseases and injuries of various kinds. The exciting cause is a

compression of the viscera, which under the pressure of the respiratory muscles tend to force their way outwards in every possible direction after the manner of fluids. As this tendency is exhibited every time we make any great bodily exertion, ruptures are consequently often produced by lifting heavy weights, running, jumping, straining at stool, and by other similar violent efforts. Pathologically speaking, the real cause of hernia is due to deficiency in and the giving way of the fibrous aponeurotic structures which surround and guard the various rings and canals in the abdominal walls. It is now clearly established that the peritoneum has little to do with the occurrence of rupture. That membrane, it is true, gives a necessary and valuable support to the viscera, but it does not do so over the region of the abdominal openings any more than over other parts of the abdominal parietes. Over the internal ring careful inspection will show traces of a cicatrix caused by closure, as of the canal of Nuck, and the peritoneum is closely attached to the edges of the opening. This of course affords considerable resistance to a protrusion. Moreover, the smooth gliding surface of the peritoneum affords easy play

to the intestines, themselves provided with a similar surface, and prevents their becoming readily fixed in one position so as to make any direct and pointed pressure in one place. But it is upon the fibrous structure of the canals and rings that we must place chief reliance for the prevention of hernia. Many inguinal ruptures when they first occur are accompanied by the sense of something giving way. Doubtless this is due to the separation of the attachments of the peritoneum to the edges of the ring, together with a dilatation of the opening in the fascia. The effect of this yielding is to cause a pocket of peritoneum to be formed whose rim is the edge of the dilated opening through the transversalis fascia. This once established, the dilatation proceeds with greater or less speed, the bowel being now able to fix itself in a favorable position for stretching the fibrous tissues whenever the power of the respiratory muscles is exerted. In a normal subject dilatation cannot begin until this pocket is formed, because even though a depression at the ring exists naturally, as is often the case, still, until a well-defined rim is formed about the ring the bowel tends to slip off to one side. When dilatation has

once begun, the peritoneum thereafter affords but little obstacle to enlargement of the tumor. Its aerolar connections in the groin are so lax and loose that the amount needed for the extension of the sac can be furnished without much distention of peritoneal tissue. Moreover, the neighboring false ligaments of the bladder, which are merely folds of peritoneum, afford plenty of material for a sac, particularly of a direct hernia. The fibrous walls of the canal and the stout pillars of the external ring effectually oppose any extensive dilatation, and it is only when the hernia emerges from their grasp and passes into the scrotum that an almost unlimited increase in size of the main body or fundus of the rupture takes place.

Many of the early operations for the cure of hernia consisted essentially in efforts to effect the closing of the hernial sac. The almost general failure of all these operations to afford permanent relief, even though the closure of the sac was finally effected, is another proof of the impracticability of relying upon peritoneum to keep back a protrusion. Pathology also leads us to the same conclusion. Sometimes the neck of the sack, *i. e.*, that portion which is engaged in the canal, be-

comes thickened and gristly through age, friction of the truss, or inflammation, so that it resists dilatation. A further protrusion can then take place only by pushing this hardened ring before it, or to one side. Yet so feeble is the resisting power of the peritoneum that this often occurs, and a rupture with an hour-glass contraction of the sac is the consequence. But that the peritoneum does not constitute the great bulwark to the occurrence of hernia, may be reasoned from analogy. Professor Wood urges "that the lining membrane of the arterial system does not form the chief resistance against aneurismal dilatation, nor is the synovial membrane of the joints their principal bond of union."

A discussion of the causes of hernia would not be complete without allusion to the fact that this malady is almost peculiar to man, and rarely occurs in other animal organizations. This is because man is the only animal that habitually assumes the erect posture. As an example of the almost instinctive feeling of weakness in the abdomen in our species, may be instanced the frequent practice among laboring men of binding the belly tightly with some rude bandage when about to

undertake any extraordinary lifting, swinging of sledge hammers, or other powerful exertion.

External or Oblique Inguinal Hernia. This is the most common variety of hernia in the male, and occurs much more frequently on the right than on the left side of the body. It emerges from the abdominal cavity at the internal ring, passes into the upper portion of the sheath of the spermatic cord, and descends in front of its vessels to the scrotum. While occupying only the internal ring and confined to the inguinal canal, it is called an incomplete hernia, or bubonocoele; after it has emerged from the external ring and descended into the scrotum, it is called a complete or scrotal hernia. The shape of a complete inguinal hernia is usually pyriform, the mouth of its sac is at the internal ring, its neck occupies the canal, and its body and fundus distend the scrotum. While the hernia remains in the firm grasp of the canal, its existence may remain unnoticed, and usually requires careful diagnosis. Once in the loose cellular tissue of the scrotum there is no longer any restraint to its growth, and either an operation for radical cure or some mechanical support is absolutely essential. Neglected herniæ

have been known to reach even to the knees, though such an abnormal development is rarely seen in civilized countries where the use of the truss is almost universal.

If an inguinal hernia is dissected, there will be found beneath the integument the superficial fascia, which usually constitutes the principal thickness of the coverings, especially if the patient is inclined to obesity. Underneath this fascia is a cellular membrane which is derived from the external oblique aponeurosis, and which varies in thickness, according to the age and size of the hernia. Beneath this membrane is the cremaster, the muscular fibres of which in old herniæ become developed so as to constitute a prominent portion of the envelopes of the protrusion. Upon the removal of the cremaster and of the membrane which covers it, the infundibuliform process of the fascia transversalis is exposed; under this, and connected with it by a quantity of soft cellular tissue, is situated the hernial sac proper. This is somewhat thicker than the peritoneum above with which it is immediately continuous.

The external pudic arteries, superficial and deep, are distributed upon the sac and its coverings,

their branches being much enlarged in old and large herniæ. The spermatic vessels and vas deferens are situated behind the upper part of the sac; the testicle is either directly beneath, or, in very large herniæ, behind its lower part. Although usually found behind the hernial sac, the different parts of the spermatic cord are sometimes separated or displaced by the hernia so that a part, or the whole of them, may pass along the sides or in front of the tumor. Likewise the testis has been found in front of the sac.

Oblique hernia is sometimes called *external* from its important relation to the epigastric artery. This vessel passes along the inferior and internal sides of the internal ring, and consequently, when a hernia passes through this opening, will surround the corresponding sides of the mouth of the sac.

The abdominal rings in a normal condition are separated from each other by the distance of about an inch and a half. This is not the case, however, after a hernia has existed for some time, for the weight of the protrusion alters the position of the parts so as to bring the internal ring near to, or even directly behind, the external, causing a more

or less direct opening into the abdomen. Such cases are often difficult, or sometimes impossible, to diagnosticate from direct hernia. The relation to the epigastric artery of course remains the same as before, except that the vessel surrounds the mouth of the sac more completely.

In oblique hernia the shape of the opening of the external ring is usually obliquely ovate. The internal ring is in most cases somewhat smaller, so that the narrowest portion of the sac is at its mouth. Sometimes the external ring retains more or less of its natural character of a slit, and such cases are often very favorable for operation. The edges of the pillars are always somewhat everted in a hernia which has existed for some time, especially of the outer pillar, and they are thinner and sharper than in the natural condition. Sometimes the outer pillar appears to be partially torn away from its insertion, causing a very free external opening. Such cases need the most careful management.

Oblique Hernia in the Female. In woman the inguinal canal gives passage to the round ligament of the uterus, which after passing through the external ring terminates in the adipose tissue of the

pubes. As this ligament is much smaller than the spermatic cord, the abdominal rings through which it passes are correspondingly diminished in size. Therefore, inguinal hernia is a much less common affection in the female than the male.

The sac of the hernia in the female is deficient in the covering formed in the male by the cremaster. It also receives a thinner covering of fascia from the columns of the external ring. On account of the small size of the external ring, the hernia is not only for a long time confined to the inguinal canal, but after its escape is apt to be so constricted as to present the appearance of two tumors, one of which occupies the canal, the other the labium pudendi. In other respects oblique hernia does not differ essentially in the two sexes.

Congenital Hernia. In the foetus there is free communication between the cavity of the peritoneum and that of the tunica vaginalis of the testis. At the time of birth, or soon after, this should be closed and the connecting passage obliterated. Sometimes, however, this passage remains open; and this state of the parts favors the descent of a hernia, which follows the course of the spermatic cord, and is, therefore, always an external or ob-

lique hernia. The spermatic vessels and the epigastric artery have the same relative positions as in oblique hernia. The testicle, however, instead of being inclosed in a separate cavity, is contained in the common sac, and is in direct contact with the herniary bowel.

The growth of an ordinary oblique hernia is usually slow, for it must form its sac and its passage as it advances. A congenital hernia, on the other hand, descends at once into the scrotum, the sac being already formed, and occurs most frequently at a time of life when the fibrous structures are imperfectly developed.

Infantile or Encysted Hernia. The connection between the peritoneum and the tunica vaginalis may become obliterated at the external ring, and yet remain pervious both above and below that point. A hernia may then descend to the occluded portion, and, on further protrusion, passes behind it to the scrotum, and becomes "encysted." If such a hernia is operated upon for strangulation two serous cavities will be met with: the first is the abnormally large tunica vaginalis, containing the testis, the second is the true hernial sac, lying behind the first and more or less embraced by its posterior wall.

Internal or Direct Inguinal Hernia. Instead of entering the internal ring and passing along the whole length of the inguinal canal, protrusions sometimes occur immediately behind the external ring, and pass through it to the scrotum. From the course it pursues, this variety of rupture is called direct hernia, in contradistinction to the common or oblique variety; while from its relation to the epigastric artery, which passes by the outer side of the mouth of its sac, it is denominated internal.

Direct hernia always emerges from the abdominal cavity at some point in a triangular space, behind the external ring, bounded, internally, by the outer edge of the sheath of the rectus muscle, externally, by the epigastric artery, and at its base by Poupart's ligament. This space is known as the triangle of Hesselbach. Sometimes the hernia emerges from the outer third of this triangle, and, passing along the inguinal canal, presents the appearance externally of an oblique hernia. More commonly, however, it either ruptures or pushes before it the conjoined tendon, and passing directly through the external ring forms a globular-shaped tumor upon the pubes.

The size and form of a hernial tumor largely depend not only upon the variety to which it belongs and the resistance afforded to its growth by the neighboring parts, but also upon the length of time it has existed.

An oblique hernia which has suddenly appeared and descended to the scrotum will be pear-shaped; its neck will be long and narrow, and extend obliquely outwards from the pubes. After a length of time it will enlarge the internal ring and drag it towards or behind the outer ring, whereupon the obliquity of its neck will disappear, and the hernial sac will communicate more or less directly with the abdomen.

A direct rarely attains to so large a size as an external hernia; it also has a more rounded form and a shorter neck, which is situated nearer to the pubes; and has a more direct passage into the abdomen. These latter points may serve to distinguish it from an old oblique scrotal hernia, though often the diagnosis is very difficult, if not impracticable.

The action of the rectus muscle is very conspicuous in the extension of inguinal hernia when once dilatation has begun. Not only does it pow-

erfully compress the viscera on account of its investment by the upper part of the aponeuroses of the other abdominal muscles, but, at its lower borders, by dragging upon the transversalis fascia, it tends to open the rings more freely and draw upwards the superior pillar.

All the varieties of inguinal hernia are liable to complications with other ailments, especially hydrocele or varicocele, and the various diseases of the genitals.

Femoral Hernia. In the female, owing to the greater size of the pelvis, the space between the crural arch and the margin of the bony pelvis below is considerably larger than in the male. The muscles and vessels, on the other hand, which pass beneath the crural arch and occupy this space are smaller, and Gimbernat's ligament is shorter than in the male. From these conditions it results that women are much more subject to femoral hernia than men. In old age the muscles become atrophied, and in consequence this space is less closely filled. Hence the frequency of this variety of rupture in the old of both sexes.

The course pursued by a femoral hernia is first downwards, then inwards, and at last upwards.

After entering the crural ring, it descends and fills the crural canal, at the bottom of which its further downward course is prevented by the firm attachment of the femoral vessels to their sheath. If the fibrous structures of the canal are very resisting the tumor may remain for a long time thus *incomplete*. The crural ring becomes dilated, and the femoral vein is encroached upon by the pushing outwards of the septum which separates it from the femoral artery. Usually, however, the protrusion then turns inwards and dilates the inner wall of the canal, that being the part offering the least resistance by reason of the existence of the saphenous opening. Through this it passes, and as the superficial fascia and the fascialata are so firmly united at the lower edge of the opening that the hernia is unable to separate them, it is compelled to turn upwards upon the falciform process of the fascia lata and the lower part of the external oblique aponeurosis.

A femoral hernia in its passage from the abdomen, receives the following coverings: I. A prolongation of peritoneum, which is pushed before it and forms its sac. II. A quantity of cellular tissue, which separates the peritoneum from the sep-

tum crurale. III. The septum crurale. IV. The sheath of the femoral vessels. V. The cribriform fascia. VI. The outer layer of the superficial fascia. VII. The integument.

Umbilical Hernia. In the foetal state, and at the time of birth, an opening exists in the linea alba and abdominal integument for the passage of the umbilical cord. The functions of the cord cease with the advent of respiration, its vessels become obliterated, the margins of the opening in the linea alba contract, and the integument closing over forms the puckered cicatrix known as the umbilicus, or navel. But the umbilical ring, although it contracts, is yet never wholly closed by tendon, for a space sufficiently large to admit a quill remains and is filled only by the remains of the atrophied umbilical vessels. Posteriorly, the umbilical ring is closed by the fascia transversalis, between which and the peritoneum lying beneath it the obliterated umbilical vein is seen passing upwards to the liver and constituting its round ligament; whilst the urachus and the remains of the umbilical arteries pass downwards to the fundus and sides of the bladder.

The peritoneum in the neighborhood of the

navel is not only thinner than in the inguinal region, but it is also so closely connected with the linea alba and adjacent tendinous parts as to be incapable of that displacement which it undergoes in forming the sacs of inguinal and femoral herniæ. From these anatomical facts it also results that while still of small size an umbilical hernia is found on dissection to be enclosed in a peritoneal sac which is covered by the fascia transversalis and the integument, but, as it enlarges, it stretches, attenuates, and blends together these three coverings so as to cause them to present the appearance of a single membrane only. This is so thin that the motions of the contained bowel can often be distinctly felt or even seen through it. Yet even in such cases we can generally recognize the separate tissues on the neck of the tumor.

If the patient is of spare habit, this rupture will hang downwards as it enlarges, and acquire a pyriform shape; if, on the contrary, he is inclined to obesity, it will gravitate less, and present a more rounded form. Sometimes, owing to a large deposit of fat between the abdominal muscles and the integument, the tumor, instead of appearing externally, passes beneath the fatty tissue and

only causes a more or less diffused swelling in the umbilical region.

Umbilical hernia is next to oblique inguinal hernia in the frequency with which it is met by the surgeon. It occurs most commonly in infants and young children. In adults it is for the most part met with in fleshy women of middle life who have borne many children, and in whom the tendency perhaps existed from childhood.

Diagnosis of Hernia. The earliest indication of the existence of a reducible hernia is usually a slight fullness occurring at one of the situations liable to rupture. This fullness increases more or less rapidly until a distinct tumor is formed. The tumor disappears when the patient assumes the recumbent position and pressure is applied, but soon reappears if the pressure is removed and the erect position is resumed. When the patient coughs, or in any manner causes forcible and sudden contraction of the diaphragm, the tumor is seen to expand and an impulse can be felt by the hand if placed upon it. At the same time a sense of weakness or pain in the part is experienced.

The sensation which a hernia communicates to the touch will vary according to its contents. If

these consist entirely of omentum, it will feel soft, doughy, and inelastic, and most probably there will be detected inequalities in its surface. If, on the other hand, the tumor contains intestine, it will feel soft, and, in addition, more or less elastic, and its surface will be smooth and homogeneous.

When an enterocele is reduced, the bowel slips back suddenly into the abdomen with a gurgling sound. But omentum is replaced slowly and without noise, and, when it is again protruded, it slips down slowly and gradually, thus differing from intestine. When a hernia contains both bowel and omentum, the symptoms of enterocele and epiplocele will be combined. The constitutional symptoms liable to be produced by a reducible hernia are nausea, sometimes vomiting, a tendency to constipation, and pain and distention of the abdomen. But these symptoms are by no means always present, and it is not unusual for a person to have reducible hernia for many years and suffer little or no inconvenience if the rupture is properly supported by a truss.

Differential Diagnosis. The affection most frequently mistaken for inguinal hernia is varicocele. This, like rupture, disappears in the recumbent

position, and also, if of large size, dilates upon coughing. According to Sir Astley Cooper, the only sure method of distinction is this: "Place the patient in the horizontal posture, and empty the swelling by pressure upon the scrotum; then, putting the fingers firmly upon the upper part of the abdominal ring, desire the patient to rise; if it be hernia, the tumor cannot reappear as long as the pressure is continued at the external ring; but if it be varicocele, the swelling slowly returns with increased size, owing to the return of blood into the abdomen being prevented by the pressure. The diagnosis will also be materially assisted by the peculiar ropy feel of a varicocele, which gives the idea of a bundle of cords being attached to the outer part of the testicle."

Next to varicocele, hydrocele is most frequently confounded with hernia. The tumor of a hydrocele, though greatly resembling a hernia in form, appears first at the bottom of the scrotum, and thence, as it grows, extends upwards; it does not dilate on coughing unless so large as to have passed into the external ring; it is irreducible; unaffected by the patient's position; fluctuates on pressure; and, except when its coverings have become

much thickened, is semi-transparent so as to allow the light of a candle to be transmitted through it. A hernia does not prevent the testicle from being distinctly felt, but more or less conceals the cord ; hydrocele, on the contrary, conceals the testicle but allows the cord to be readily felt above it.

The chief diagnostic marks of a congenital hydrocele which dilates on coughing, and may return to the abdomen, are its fluctuation and transparency.

Encysted hydrocele of the cord is readily distinguished from hernia if it is situated outside the external ring, but if contained within the inguinal canal its diagnosis is more difficult. The characteristic features are the circumscribed form of the tumor, its tense or fluctuating feel, uniform size, want of impulse on coughing, and the impossibility of returning it into the abdomen.

In diffused hydrocele of the cord, we must rely for differential points upon the fluctuation of the watery tumor at its lower part, and the imperfect reduction of the swelling under pressure, while the cord is left softer than natural and less easily felt. After the reduction of a hernia the cord is left comparatively round and firm, and there is a tan-

gible escape from the abdomen when a rupture returns after reduction. Sometimes, moreover, there is a visible enlargement of the inguinal canal when the fluid of a diffused hydrocele is forced violently upwards.

A hæmatocele differs from rupture in its history, its solid form, lack of impulse, and by its concealment of the cord.

From an abscess descending into the inguinal canal hernia is to be distinguished by its want of fluctuation, its firmer feel, and, if it contains intestine, by the gurgling sound produced when the latter returns into the abdominal cavity.

Sarcocele differs from hernia in its rounded form, hard feel, lack of impulse, and by not implicating the cord or occupying the inguinal canal.

The error of mistaking an undescended testicle for a hernia will not occur if we examine the scrotum, or consider the peculiar sickening pain which pressure of the gland produces.

Tumors which sometimes form upon the cord will be recognized by their history, their small size and circumscribed form, and by the absence of impulse on coughing. The same characteristics will enable us to distinguish an enlarged inguinal

gland from a hernia. Not unfrequently, however, an enlarged gland exists simultaneously with and covers over a hernial protrusion. When, from the symptoms of strangulation, we are led to suspect such a condition, we should always, if there is imminent danger to life, cut down upon the gland and determine whether a hernia exists beneath it.

The diagnosis between femoral and inguinal hernia is determined by ascertaining the relation which the neck of its sac bears to Poupart's ligament. In femoral hernia, the neck passes below the ligament, in inguinal above it. In some instances the two forms have both been observed on the same side.

Psoas abscess somewhat resembles femoral hernia in its situation, in disappearing in the recumbent position, and in dilating on coughing. It differs from it in its history, in its soft and fluctuating feel, and in producing no gurgling when it is returned to the abdomen. Its situation is also rather more external than that of the hernia.

Varix of the femoral vein may occur in the same situation as a hernia, it also dilates on coughing and diminishes in the recumbent position. The true nature of the complaint is to be determined

by its history, by noticing that other parts of the vein are simultaneously affected, and by the reappearance of the swelling while pressure is being made at the femoral opening which would prevent the descent of hernia.

Frequency of Hernia. Hernia is one of the most frequent of infirmities, and various eminent surgeons have estimated that it occurs in from one eighth to one sixteenth of all mankind. Such estimates, however, are probably much exaggerated, and are not borne out by the numerous modern statistics of military drafts in various countries. The following table is taken from Dr. J. H. Baxter's "Statistics of Examinations for Military Service in the U. S. Army during the late War of the Rebellion," published by the government, and shows the curious correspondence of results obtained in France and the United States.

The draft included only men from eighteen to forty-five years of age, and it is probable that the percentage thus obtained would be somewhat increased if men over forty-five years of age had been examined, inasmuch as the liability to hernia increases with advance in years. The greater percentage of hernia in the volunteers is to be ac-

counted for by the large bounties offered for recruits which tempted men to present themselves for examination in the hope of concealing a hernia. On the other hand, in the preparation of the lists of enrollment for the draft many men known to have hernia were stricken from the lists by the local officers previously to the draft, in order to diminish their quota.

STATIONS, ETC.	Period of observation in years.	Total number examined.	Total number rejected.	Rejected because of hernia.	Millesimal ratio of rejection because of hernia.
France	3	126,669	46,669	-	31.200
Department of the Seine .	11	26,083	11,148	-	31.900
United States (volunteers)	2	501,068	162,820	22,285	44.475
United States (drafted men)	2	501,002	141,688	15,847	31.681

With regard to the relative proportion of the different kinds of hernia, the following table, also taken from Dr. Baxter's excellent work, shows the result of the examination of 334,321 "recruits, substitutes, drafted and enrolled men" of various nativities throughout the United States. The reader will observe that the cases of right inguinal

hernia exceed in number those of all the other varieties put together.

DISEASE.	Number rejected.	Ratio rejected.
Hernia, kind not specified	651	1.947
Hernia, umbilical	317	0.948
Hernia, ventral	828	0.981
Hernia, right inguinal	8,598	25.718
Hernia, left inguinal	5,420	16.212
Hernia, double inguinal	1,166	3.488
Hernia, right femoral	277	0.829
Hernia, left femoral	110	0.829
Hernia, double femoral	84	0.102
Total for hernia of all kinds	16 901	50.554

CHAPTER II.

RADICAL CURE OF REDUCIBLE HERNIA.

Preliminary Remarks. In treating of the permanent cure of rupture, I shall have reference at first chiefly to the oblique inguinal variety only, and shall afterwards explain such modifications in treatment as are necessary in dealing with other forms of reducible hernia.

It has been heretofore stated in treating of the pathology of rupture that its occurrence is largely due to a weakness, either hereditary or acquired, in the fibrous or tendinous structures that form the boundaries not only of the rings but of nearly the whole track of the inguinal canal. It therefore occurred to me very early in my investigations concerning an affection whose cure has been attempted hitherto so unsuccessfully, that it would be well to confine my efforts to these tissues only. It seemed almost certain that if these fibrous

tissues, which are nature's chief bulwark against hernia, could be strengthened or in any way restored to a natural condition, the long-sought cure of rupture would be accomplished.

It is worthy of observation that all of the operations which have been at various times proposed for the cure of hernia may well be classed among the severe, if not violent, procedures of surgery. Their performance is always succeeded by more or less inflammation, which is often quite extensive, and in some cases is uncontrollable and dangerous. In Gerdy's, Wutzer's, and Wood's operations, which, though now discarded, obtained in their day considerable notice, an attempt was made to close the hernial opening with a plug formed either of the adjacent integument or of the invaginated scrotal tissues or of both, in expectation that adhesions would form sufficient to retain this rude plug in position and thus prevent the descent of the protrusion. But even when the violence of the inflammation thus usually excited has subsided and afforded the surgeon an apparent success, the tendency of nature is to get rid of these tissues, which are like foreign bodies in the canal, and the rupture usually soon recurs. But I have alluded

to these operations only to remark upon the feature which is common to them all, and which seems to me the true reason why they fail to cure, namely, the excessive and generally suicidal degree of inflammation produced by them one and all. This is the reason why they have not been and never should be generally received as accredited operations; and the same remark applies to my own early operations for radical cure by means of injection of the essential oils. My attention was first drawn to this by observing with some surprise that whenever in my operations the early result was seemingly unsatisfactory because of too little apparent effect, it proved the best as to permanent cure, and I was thus led to persist in efforts which at first were thought likely to prove utterly futile.

I lay it down, therefore, as a cardinal principle in all operations for the cure of hernia, that any inflammation except of the mildest grade must be carefully avoided. If the surgeon cannot operate without producing the four cardinal principles of inflammation described by Celsus, namely, heat, pain, redness, and swelling, he had much better let his patient alone, and not do harm, for such a result cannot do good.

It is important to avoid inflammation not only because its occurrence weakens if not utterly prevents the alterations we aim to produce by operating, but also because it compels an early abandonment of the means we make use of to support the protrusion during the process of cure. If inflammation is once allowed to occur, the truss or bandage which should be worn for a time will cause much discomfort, and must of necessity be removed. In fact, the patient himself will soon take this off if the surgeon does not, and thus all possibility of a cure will be prevented at the outset.

Gradually convinced of the truth of the above considerations, for a long time I patiently sought for a practical means of accomplishing this desired avoidance of inflammation, and after eight years of discouraging experiment discovered a process which I call *the method of tendinous irritation*. This form of treatment I have now practiced for many years and in many hundreds of cases, so that I am now well convinced of its value. It may be briefly described as consisting of a mild irritation of those portions of fibrous tissue lying directly in contact with the exterior of the neck

of the hernial sac, thickening and consolidating their substance, and effecting a contraction of the openings. This contraction is due not only to the astringent used as an irritant but also largely to the peculiar normal distribution of the bundles of fibre in the neighborhood of the abdominal rings. Below are given two modes of operation, by either of which it is possible to effect a cure, and I myself use them indifferently.

Operation for Radical Cure. (Liquid method or method of injection.¹) The operator must be provided with an instrument somewhat resembling the ordinary subcutaneous syringe, which is loaded with the modicum of irritating fluid. This instrument as well as the special form of irritant used will be fully described below. The patient should be placed on the bed in the recumbent position, and the contents of the hernia returned within the abdomen. The position of the patient then usually suffices to prevent the return of the

¹ This operation, though it may be termed the operation by injection, should not be confounded with the operation of injection alluded to in many text-books of surgery, which consists of an injection of the *interior of the hernial sac* with tincture of iodine or some other inflammatory agent.

protrusion while operating. If not, it should be retained by the finger of an assistant. The hernial sac also should then be returned to the abdomen if possible. It is true that in the majority of cases this cannot be done, yet the effort should always be made in order to empty the canal as much as possible. If it cannot be returned, the sac may be allowed to remain in its accustomed position, as its presence in the canal only somewhat diminishes the effect of the operation, but not by any means actually prevents an entirely satisfactory result. Armed with the instrument, which is supposed to be charged and prepared, the operator introduces its beak into the inguinal canal, but outside of the sac, if this has been suffered to remain, in the following manner: invaginate the right forefinger in the scrotum and find the external abdominal ring, then with the left forefinger press perpendicularly upon the integument directly over this ring, and use sufficient force to, if possible, press the integument together with the finger directly into the ring. The left forefinger being at or in the ring, the spermatic cord and the sac, if in the way, are to be pushed to one side so that nothing may remain between the external pillar of the ring and

the finger except the integument and subjacent superficial fasciæ. Keeping the left forefinger thus, take the instrument in the right hand and introduce its freshly sharpened and polished beak *quickly*, penetrating the integument and superficial fasciæ, just passing but not grazing the external pillar, and entering the canal at once. Then remove the left forefinger and gently insinuate the beak further on, well into the canal, exercising the greatest care not to impinge upon the spermatic cord, which is sensitive to the slightest touch, or upon the fibrous walls of the canal. To wound any of these parts endangers the success of the operation, and to penetrate the transversalis fascia would be particularly unfortunate. If the operator in attempting to pass through the ring should impinge upon or transfix one of the pillars (an accident to which the tyro is very liable), the instrument will not be able to be freely and easily moved about, which it is to a remarkable extent when the canal is successfully entered. But before proceeding any further the surgeon may do well to confirm his diagnosis of position by transferring the instrument to the left hand, while with the right forefinger invaginated in the scrotal tissues

he explores the inguinal region, and examines the exact situation of the beak. Beyond the prick of the puncture the patient suffers but little pain if the introduction is skillfully performed. But any awkward movements of the beak about the spermatic cord will cause sharp pain, which is referred to the testicle or to the deeper parts of the abdomen.

Having satisfied himself that the beak of his instrument is in the canal, the surgeon then deposits about ten minims of the liquid irritant, emitting it drop by drop and spreading it as much as possible. The beak of the instrument should be well swept about while delivering its contents, passing around the exterior of the sac if unreduced and wetting all the fibrous tissues. Particular care should be taken that the intercolumnar or arciform fibres and the inner edges of the external ring are wet with the irritant. The canal is usually found much more free than would be anticipated, and any adventitious adhesions can be either broken or avoided. A small though essential amount of the irritant should be placed in the extreme upper portion of the canal, so as to operate upon the fibres embracing the internal abdominal

ring. Owing not only to its proximity to the abdomen, but also, and more especially, to the usual presence in the upper part of the canal of a few muscular fibres of the internal oblique, the sensitiveness to irritation here is extreme and the slightest amount of material produces all the effect that is usually desirable.

Having wet the entire fibrous interior of the canal and of the inguinal rings, the beak is then withdrawn quickly so that none of the injection may be left in the cellular tissue and fasciæ lying beneath the integument and just exterior to the external abdominal ring. At the instant of withdrawing the beak press the finger over the puncture, thus preventing any oozing of blood which might occur if the skin is delicate, and also in the case of a hernia with a free opening hindering any of the injection which has not been absorbed from oozing outwards. The application of the irritant may cause some slight immediate pain, which is soon allayed by the morphine which is contained in the injection. The previous protrusion should not be allowed to descend after the application of the irritant, nor the patient be permitted to assume even the sitting position, until a suitable

bandage or other means of support has been properly applied.

The Irritant. Take of Thayer's Fluid Extract of Quercus Alba, prepared in vacuo, one half an ounce; of the solid alcoholic Extract of Quercus Alba, about fourteen grains. Triturate with the aid of gentle heat for a long time in a mortar until the solution is as perfect as possible. It is well not to exceed this amount of the solid extract, else the mixture will be too irritating. I usually prepare a quantity of this mixture sufficient for six month's or a year's supply, and am very cautious in first using it, adding a little more of the solid or the fluid extract, accordingly as I observe it produces too little or too great an effect. Having once adjusted the proportions in this manner, and satisfactorily tested the mixture, I use it and no other until the supply is exhausted. The proportions never need vary much from what is stated above. In preparing a new mixture I always get the extracts fresh from the laboratory, and am particular to procure fluid extract which has been concentrated *in vacuo*.

Of late years it has also been my habit to add to this mixture the sulphate of morphine in the

proportion of about one grain to the ounce. This has the effect of diminishing the dull aching that follows the operation, which is caused by the irritation of tendinous tissue. It also serves the further purpose of constipating the bowels, which is also induced by the tannin in the mixture. The amount of this mixture used at any one operation is, as said before, about ten minims.

The Instrument. The instrument used is shown in Fig. 1.

It consists of a silver cylinder (A) about two inches and a half long and three sixteenths of an inch in diameter, capable of holding about twenty minims. A solid rod of metal (B) is fitted closely to it, and forms a piston. A rod or wire of steel about the size of an ordinary darning-needle, and over an inch in length forms the beak or nozzle (E). This is bored with a small drill from the cylinder to D. At D a minute transverse puncture or double opening is made, communicating with the bore. At E the solid portion of the steel rod is flattened and sharpened, being spread



FIG. 1.

out so as to cut an opening in its passage through the integument slightly larger than is absolutely needed for the introduction of the remainder of the nozzle, thus allowing free movement of the beak while in the canal, and enabling the operator to exercise his sense of touch through the instrument and secure a delicate appreciation of contact. The cut shows this beak edgewise, so that this widening is not evident.

A subcutaneous needle made in this manner from solid steel possesses a firmness and rigidity which I have never been able to obtain in the needles of the more modern morphine syringes. The latter are made by rolling and welding thin plates of steel about a solid rod which is afterwards withdrawn, and possess but few of the qualities which I prize in the needle I have described.

The Bandage. As soon as the irritant has been applied and the instrument withdrawn, a suitable support for the rupture must be applied. This may consist of some special form of light apparatus or truss, or better still, in the majority of cases, of a bandage with compress. The proper application and regulation of the bandage is of great importance, much more so than would be supposed, and

has a marked influence on the percentage of successful results. I generally use a bandage instead of a truss, employing, by preference, the ordinary unbleached cotton drilling, which is firm in texture and not easily stretched, and make what may be termed a pin-bandage. A strip of this drilling, doubled so as to be about two and a half inches wide, is passed around the body, like a belt, a little below the anterior superior spinous process of the ilium, the ends drawn tightly and pinned together over the median line in front with a dozen pins. A second narrower strip is then pinned to this belt so as to fall just behind the trochanter major of the hip bone, is passed beneath the thigh and cut off of a length, so that it may answer the same purpose as the thigh strap to a truss. A pad or compress is then to be made by folding together many thicknesses of cotton drilling. In some cases softer material is more suitable for the compress. The shape and size of the pad must be specially adapted to the case in hand. It should be long enough to press upon the whole length of the canal and should shelve off somewhat above, so as to bear with comparative lightness over the internal abdominal ring. The various niceties in shape and

adjustment of pads must be learned by experience, just as one can learn to fit a truss properly only by a practical knowledge of what is desirable and possible with a truss. Having finally shaped the pad to suit, it is then to be placed in position over the canal, and the belt drawn down over its upper edge and pinned there. Now, if the belt has been fastened about the body *tightly*, it will, when thus drawn down upon the pad, tend to draw upwards. To counteract this tendency, the thigh strap is brought up directly over the pad, being tightly drawn and pinned there, tends to draw downwards. And it is readily seen, that as a resultant of the direction of these partially antagonistic forces, the pad is pressed *inwards*, and by a little regulating or altering of the bearings, it can be made to press *upwards* also, so that the pressure may be more nearly in the direction of the canal. It is quite common for patients to remark upon how tightly they are bandaged, which may give some idea of the firmness and tightness of the compress as usually applied.

In operating, it is most convenient to partly adjust the bandage shortly before the actual operation, in order that there may be less delay in its

application thereafter, and no necessity for the patient to move, or to exert himself in facilitating its adjustment.

A bandage is preferable to a truss after operating because it can be more accurately adjusted, and can be made to stay in place better than any truss, also because it can be worn with comfort while lying down. A spring truss always tilts up on lying down, because the spring is pressed forward. Even an elastic truss can be worn with comfort in bed by only a few persons for any length of time. All trusses, also, are too harsh to be applied directly after operating, without careful watching. Moreover, the patient will always find some excuse or other for taking off a truss temporarily, or for moving it out of place, but a firmly pinned bandage he respects as he would a bandaged splint on a broken limb.

After-effects. Following the operation, after an hour or so, there occurs a dull local pain, or rather aching of the groin, which, after attaining a moderate degree of acuteness, gradually subsides, and disappears altogether in from six to twelve hours. After this, there is no pain if the patient avoids exercise. No swelling appears, nor any local red-

ness, nor any increase of temperature in the groin. If, by the second day, gentle pressure is made over the canal, a considerable degree of sensitiveness will be observed, which may even amount to tenderness if the pressure is made over the internal abdominal ring. This tenderness diminishes very much after two or three days, and at the end of a week it is only to be felt by making firm pressure into the groin. Meanwhile the bandage is to be kept upon the patient continually, and ordinarily he is not to be allowed to walk about, or even to sit up, until the greater portion of this early tenderness has disappeared. During the first few days of the second week, exercise in walking should be somewhat restricted, and, if it causes any symptoms of increase of tenderness, the patient should be directed to keep quiet for a day or two longer. If, by any excess or indiscretion in exercise, it should become necessary to diminish the pressure of the bandage, he should be made to lie on his back still longer. After the second week the patient can generally be allowed to return to his usual avocations, provided they are not physically laborious, in which case he should be cautioned against too great exertion for a few weeks more. It is my

usual custom to dismiss patients with the direction to wear the bandage until it is worn out, and then to discard all mechanical support. On seeing them two, or three, or six months afterwards, I generally find them still continuing the bandage. I then usually cut it away, and, if I find, as I almost invariably do, that the desired changes have taken place, I consider the case successful, or, as the phrase is, "radically cured."

In many cases it is safe to remove the bandage and to abandon all means of supporting the hernia after six or eight weeks. It is especially so with small recent herniæ or those with small openings. If the protrusion contained any portion of omentum, however, it is better to continue the support for a much longer time. When a patient resides so far away that I am unlikely to be able to see him again, I frequently, on his departure, take off the bandage and substitute a light truss to be worn for a few months. This is always an excellent practice if the hernia had a large opening, or if, for any other reason, there is more than ordinary need of support. A bandage is very liable, after the wear of a month or so, to become relaxed and needs to be tightened. Many patients are able to realize

this and to readjust it for themselves. Others cannot be depended on to give much thought or attention to the matter, and are, therefore, better off with a truss. The practical objection I have to this use of the truss is, that it does not wear out quickly as does the bandage, and I am frequently chagrined to find patients who were successfully operated upon, perhaps several years previously, still wearing a truss. They had been sent away with one on, and felt a certain fear of discarding it, especially if influenced by some incredulous physician. Still, it is undeniably better that the support should be worn for too long rather than too short a time after the operation.

It is always advisable, after operating, that the patient should be restricted to a light farinaceous diet for a few days. It is also always well, if possible, to avoid any movement of the bowels for three or four days afterwards. A light diet and the absence of exercise, assisted by the constipating effects of the irritant used, are generally sufficient to delay dejections, and thus any risk from straining and other like exertions may be avoided.

The Solid Method. This is a modification of the preceding or liquid method, differing from it

not in principle but in minor operative details. It consists of substituting for the liquid injection a thick paste or semi-fluid mixture prepared by triturating the solid with the fluid extract of *Quercus Alba* until we obtain a viscous paste so soft as to be easily spread over the fibrous surfaces. The advantage of using this paste is that a very little of it (two grains or less) produces sufficient irritation, and it can be smeared over the fibrous surfaces with less risk of irritating other parts than can the liquid injection. Moreover, the irritation thus produced is more sustained, being due to a more persistent cause than in the liquid method, as a liquid injection is quickly absorbed. This is a decided advantage in large herniæ, and generally in all those herniæ wherein for any reason it is probable from the outset that, if the liquid method is employed, a repetition of the operation will be necessary. This method should not be used until some practical skill in the treatment of hernia has been acquired, because if, from want of such skill, the paste should be left in a mass, the excess at any one point would excite an undue degree of irritation or inflammation there.

For the introduction of such small amounts of

thick or solid matter, the syringe is not available on account of the necessity of an exact method of regulating the amount of material employed. Below are figured two instruments, either of which is convenient for this purpose.



FIG. 2.

The instrument shown in Fig. 2 consists of a steel tube P B, which is fitted at one end into an ivory handle, while the other is welded to a solid beak or plunger E, somewhat larger than the tube itself. At B is an opening or groove which is filled with the irritating paste. A silver sliding-tube, A, is then pushed down so as to cover and close the groove at B, and when in this position makes a smooth continuous shaft with the beak E, and can then be readily introduced into the inguinal canal. When in the canal, the groove of the tube P B can be gradually uncovered and the contained material rubbed off. The rod or wire C passes through the whole length of the tube, and serves to dislodge the contents more completely.

This instrument is only available for small herniæ. Where a larger amount of irritant

is necessary, recourse may be had to the instrument shown in Figs. 3 and 4.

Here we have the steel tube A A, welded to a plunger E, and also fixed in the screw cap L. The cap L screws on to a cylinder H, whose cavity *n* is filled with the irritating material. Compression is exerted by screwing in the solid plug F which acts as a piston and fits closely, by means of a packing-box at *i*, to the tube A A which passes through it. The tube P B passes within and closely fits the tube A A, and is itself traversed and filled by the wire C. Both of these tubes¹ have openings at *i* and at B, which are so placed that when the inner tube A is revolved within the outer, B is open only when *i* is closed, and vice versa. To use the instrument, the wire C is pulled out so as to clear the opening at *i* which is then thrown open, and a single turn of the screw-piston F fills the small tube P B from *i* to B. The beak of the instrument



FIGS. 3 and 4.

¹ Fig. 4 shows the tubes sidewise and enlarged.

is then introduced within the ring with the opening at B closed. By turning the inner tube B B half way round, this opening is unclosed subcutaneously, and the contents of the tube are gradually dislodged by pushing in the rod C.

By withdrawing the rod C part way, and again opening the tube at *i*, it can be refilled subcutaneously by a turn of the piston, and then emptied again as before. By this means we can accurately measure the amount of irritant used, and at the same time distribute it as evenly as is desired.

Pathology. The pathology of this operation is not so simple a matter as might be supposed. The surgeon without experience in this method of treatment might predict inflammation and suppuration. But this never occurs if the operation is rightly, or even tolerably, performed. In an ordinary and typical case, no appreciable inflammation follows, nor any general disturbance of the system. By inflammation is always intended to be understood the popular or practical definition of the term, which involves the sensible presence of heat, swelling, redness, and pain. There follows this operation no appreciable increase of local heat, no swelling, no redness, and but a little fugitive

pain. A slight amount of pain attends the first application of the irritant, which after an hour or two increases somewhat, and then disappears in the course of a day. After this there remains only a slight tenderness when pressure is made over the canal.

Now how is this apparently improbable result to be explained?

I believe the explanation to be briefly this: the operation is subcutaneous, the parts affected are fibrous tissue, and the irritation itself is mild.

The parts chiefly and immediately affected by the foreign material are, with a single slight exception, fibrous or fibroid tissues, receiving but little or no red blood from the circulation, and supported chiefly by the nutritive juices. The disturbance we excite does not exceed a low grade of irritation, and the moderate amount of lymph thus subcutaneously produced has a strong plastic or organizing tendency. Also, its production is largely interstitial, thickening the fasciæ and tendons, contracting and consolidating, though not absolutely closing up, the entire fabric of the hernial or inguinal canal. Owing to the mildness of the preparation of *Quercus Alba*, the irritation ceases in

its earliest stage, and does not increase to a real inflammation, which if it occurred might readily run on to suppuration. Owing, moreover, to the peculiar slowness with which all fibrous tissues when irritated recover, as well as to the powerful plastic tendency of the lymph thus generated, the thickening, contraction, and consolidation, which follow the irritation, persist for a most remarkable length of time, so long that for all practical purposes they are permanent, or at any rate sufficiently so to enable nature to reëstablish herself and effect a cure of the hernia.

Accordingly, there is no swelling or other outward sign of inflammation. Indeed, the disturbance caused is so slight that the patient never speaks of himself as suffering from inflammation, and loses some of his previous horror of surgical operations.

Now by what circumstances are the character and products of any irritation chiefly affected? The most eminent pathologists tell us that they depend first upon the state of the blood, which necessarily involves that of the general health. But of course no one would think of performing a surgical operation of this kind upon any one who was not in good health. Therefore this ele-

ment of variation in results may be safely passed by. Secondly, we are told the character and products of an irritation depend largely upon its seat and the tissues immediately affected by the irritant. A close study of the anatomy of the rings and of the inguinal canal will throw much light upon the action produced, after which we shall consider the third element of variation, namely, the degree and amount of the irritation excited. For a description of the anatomy of the inguinal region in general we refer the reader to the standard works on anatomy, and we need here consider only the construction of the rings and of the canal itself. This channel, which is the natural opening for the passage of the spermatic cord, extends from the internal to the external abdominal ring. Its back is formed partly by the fibrous transversalis fascia, through which the internal ring is an opening, and partly also by the conjoined tendons of the two deeper abdominal muscles. Below is the tough Poupart's ligament, also fibrous tissue. In front the canal is bounded by the aponeurosis of the external oblique muscle throughout its whole length, save at its outer and deeper end where it is bounded in part by some muscular fibres from the

internal oblique muscle. Thus we see that the canal is essentially a fibrous canal, except at the outer and deeper portion where there is some muscular tissue. This outer portion should be, theoretically, the weak spot in the operation for radical cure, and we find it in practice to be the really difficult and quasi-dangerous point. This muscular development is, however, much less prominent in some people than in others, and, unless a hernia is very recent, is usually much less exposed than in an anatomically-normal canal, owing to the tendency of an oblique hernia to drag the internal ring down towards the external. It is, nevertheless, over the internal abdominal ring, and sometimes extending above it a few inches, that there may, if too much of the irritant has been used, be some pain and unusual tenderness (always, however, to be easily allayed by cold applications); and such undesirable results are, doubtless, chiefly due to the presence there of unprotected muscular tissue.

The spermatic cord passes through the inguinal canal. It is, however, protected from the action of the irritant by an envelope of condensed fibro-areolar tissue called the cremasteric fascia, which also protects the loops of the cremaster muscle.

At any rate it is certain that the cord is not sensibly affected or enlarged by the operation unless it has been injured by the beak of the instrument while operating, an accident for which there is not generally any necessity or excuse.

Besides the spermatic cord, there will remain in the canal, in the greater number of cases at the time of operating, the neck of the hernial sac. But in those cases in which the sac is irreducible, its neck at least, which is the only part that lies in the canal, has become of a fibroid or possibly even a cartilaginous tissue. Accordingly it does not introduce any added risk of inflammation.

Now the result of the irritation, upon which is placed the reliance for a cure, is solely its effect upon fibrous tissues. Whatsoever alteration, if any, is produced in other tissues, such soon disappears, and is of no account after even a few weeks have elapsed. But it is well known that, if any injury is done to a fibrous portion of the body, recovery is slow, very slow, and that the lesions or alterations in the structure and functions of such parts are likely to be partially if not wholly permanent. Witness the enlargement of the fibrous parts about joints by a mild

irritation of rheumatism ; or the alteration and contraction of the valves of the heart by a similar cause. How slow is the complete recovery of function after subcutaneous section of the tendo Achillis ; and how little swelling or apparent inflammation follows this almost capital operation. It would be very different if the tendon had the abundant vascular supply of muscular tissue. In a like manner in operating for the cure of hernia, the tissues we irritate have very few or scarcely any blood-vessels, and therefore but little red blood. The lymph produced by their excitement has a natural tendency to organize into tissue similar to that which gave it birth, thus thickening by interstitial formation the whole series of fasciæ, contracting the rings both directly and indirectly, as will be explained hereafter, and consolidating the whole inguinal region. By this latter term it is not intended to imply that opposing parts become united or fused together, but that the laxness of fibre ordinarily accompanying hernia is succeeded by more or less firmness and tension, sufficient for the cure.

This thickening of the fibrous tissue can often be made a matter of clinical observation in cer-

tain favorable cases. An oblique inguinal hernia which has long existed tends to evert the pillars of the external ring and to thin or sharpen their edges, particularly that of the outer pillar. (Often in the case of a patient of thin habit of body have I observed by the sense of touch several days after operating, or as soon as I could freely examine the external ring, that this condition of attenuation was undergoing a change, that a thickening of the cord-like tendon was taking place which could readily be appreciated by the fingers, and which is typical of what occurs in other portions of the canal not so open to examination.

It will be objected that the thickening produced by this operation will soon be absorbed and disappear. But this is in reality only a theoretical objection, drawn from the analogy of irritation of other than fibrous tissues, or of any tissue when subjected to a sufficiently high degree of irritation to produce inflammation. It is true only of the products of what is termed inflammatory lymph, production of which, in this operation, should be studiously guarded against. Though doubtless a partial absorption of the material added to tendon and fascia may occur if an unnecessary

amount is produced, or if accidental adhesions are formed, still this absorption occurs with such extreme tardiness that the practical result or cure is not affected by it. The thickening of the rings and canal endures so long that nature, whose tendency through subsequent contraction is always on the side of cure, is enabled to reassert herself by restoring the fibres to normal tone and proper position once more, so that ultimately there exists about the fibrous openings sufficient resistance of tissue to keep back any protrusion. Quite a number of cases have come to my knowledge, and I have always treasured them as throwing much light upon the theory of my operation, of persons who, on *suddenly* rupturing themselves, immediately applied a truss and wore it continuously for many months, and obtained, they knew not how, a cure. In such cases it is probable that nature repaired the altered tissues under the influence of the irritation caused by the stretching or possibly even tearing of the tissues by the sudden event of rupture. These cases prove, too, how little the required irritation may be, and that it is by no means absolutely necessary that the alterations in the fibrous tissues produced pri-

marily by this operation should all be really permanent from the first. Sometimes from three to six months after operating I have found that though on slightly pressing the groin the patient would say it gave him no pain, still, upon making firm deep pressure with my finger over the points operated upon, he would wince slightly, and allow that, after all, there was a little sensitiveness remaining, thus showing how long a time these fibrous tissues may take to become sound and permanent. What is contended is that, while the entire lymph-product endures much longer than would be generally supposed or conceded, the interstitial and hyperplastic changes permanently remain.

In only a single case have I been able to obtain an autopsy of a patient upon whom I had operated for the cure of hernia. Shortly before I went to Europe, in 1850, I was called to attend the last illness of a gentleman named Speare, then living in Boston near the Hotel Pelham. Five years previously I had operated upon him for the radical cure of an inguinal hernia. I called in Dr. Winslow Lewis to witness the autopsy. Upon examination of the groin, the appearances were so nat-

ural that it would not have been suspected that he had ever been subject to hernia. The fibrous parts were as firm, tough, and resisting on the side where the hernia had existed as on the side which had never been ruptured. But it is worthy of observation that although the healed side did not retain any superior thickness over the normal side, yet the pillars had lost all the thinned sharp-edged appearance which is always presented, to a greater or less extent, in all herniæ that have existed for a length of time. The interstitial deposit of fibroid material was able to persist because there was need and use for it in the economy.

Allusion has been made already, several times, to the contraction of the hernial openings which is produced by, or at any rate follows, the operation for cure. In explanation of this fact, which, when I first observed it, seemed almost incredible, I will call attention to the more or less curvilinear direction of the bundles of fibre of the various fibrous tissues which border the abdominal rings. This is most perfectly shown about the internal abdominal ring, which is wholly surrounded by fibres which curve around and embrace it. (See Figs. 5 and 6.)

The muscular fibres of the transversalis do not extend downwards so far as those of the internal oblique usually do, the lower edge of its fleshy portion terminating a little above the internal abdominal ring, which is an opening in the transversalis



FIG. 5. INTERNAL INGUINAL RING, after R. Froriep.¹

2. Internal abdominal ring, the spermatic cord and its sheath having been removed. 3. Transversalis muscle. 4. Posterior wall of the inguinal canal, composed of the tendon and aponeurosis of the internal oblique and transversalis muscles. 5. Femoral vein. 6. Femoral artery.



FIG. 6. THE TRANSVERSALIS FASCIA, after R. Froriep.¹

1. Funnel-shaped elongation continued over the spermatic cord, known as the infundibuliform fascia, or fascia spermatica interna. 2. Anterior portion of the femoral sheath. 3. Poupart's ligament.

fascia, so called. The transversalis muscle, below the point just indicated, becomes tendinous, and is continued downwards in a curvilinear direction on the inner side of the internal abdominal ring, while more or less of its tendinous fibres curve around and embrace the ring, blending with and strength-

¹ R. Froriep, *Atlas Anatomicus*, Leipsic, 1851.

ening those of the transversalis fascia. Further down this tendon unites with that of the internal oblique to form the "conjoined tendon," forming the inner pillar of the external ring, and a good portion of the back of the canal.

At the lower edge of the internal ring the transversalis fascia is much thicker than above, and is continued thus downwards to Poupart's ligament, to which it is firmly attached. Below and around the internal ring it receives many scattered fibres from the tendon of the transversalis muscle, so that the internal ring may be practically considered as encircled by a fibrous sphincter composed of fibrous fasciculæ, derived from both the transversalis fascia and tendon. Sir Astley Cooper speaks¹ of this very peculiar insertion of the lower part of the transversalis tendon, and states that it begins to be fixed in Poupart's ligament almost immediately below the commencement of the internal ring, and it continues to be inserted behind the spermatic cord into Poupart's ligament, as far as the attachment of the rectus. (See Fig. 5.)

The external abdominal ring, which is really a triangle, and becomes a ring only in some forms

¹ See Quain's *Anatomy*, page 1022, 7th edition.

of hernia, is arched over above by the intercolumnar fibres, which are thrown out from the conjoined tendon to the opposite pillar of the ring, and frequently offer a very decided resistance to the further descent of an incomplete hernia. These bundles of arciform fibres, though they do not encircle the external ring, serve to keep the thick pillars from separating, and thus preserve the natural shape of the opening.

Now, when a hernia passes down the inguinal canal, it gradually dilates all of those bundles of fibres which, to a greater or less extent, encircle the rings. The pillars of the external ring, which are too stout to be readily dilated, are pushed to one side. But when this dilatation has taken place, the fibres which formerly curved around the rings or the canal must then encircle the neck of the hernial sac. The internal ring may have been dragged down towards the external, the local anatomical relations may have been altered, some tissues may have become hypertrophied, others attenuated and wasted, yet those fibres which originally circled about, guarded, and strengthened the path of the spermatic cord must still embrace the exterior of the neck of the hernial sac which forced

its way through that path, and, if the dilatation has not been so great as to wholly destroy these fibres, a cure of the hernia is still possible by their contraction, if this can be effected.

Now, these fibrous tissues are susceptible of contraction, and contraction actually takes place, to a certain extent, directly after the performance of the operation by irritation, and continues to make progress for weeks and even months afterwards.

The astringent principles of the injection, of themselves, favor contraction, the solidification or organization also of the new material produced in and about the fibrous tissues by the irritation tends toward contraction, and, above all, nature herself, whose tendency is always on the side of cure, tries to close up by spontaneous contraction the abnormally enlarged openings. The bandage, assisted by the recumbent position of the patient, completely removes the lateral or wedge pressure previously exerted by the protrusion upon the encircling fibres, and even in a few days sufficient contraction may be produced so that the cure, or final contraction, can generally be completed by nature without further stimulus than that already induced by the injection, and without any further

interference save the careful application of mechanical support to the groin for a reasonable period.

This contraction of the rings can be proved by clinical demonstration in cases where the anatomical relation of the parts are more than usually distinct and well defined. It is best observed in patients of a spare habit of body, in whom the rings have become somewhat dilated through the neglect of proper support by the truss, but whose bodily health is so good as to keep up considerable tone of muscle and fibre. I have frequently observed it even a few days after operating, as soon as the patient would permit a free examination of the groin. The attainment, however, of the full amount possible of contraction is usually a slow process. Nevertheless, though this require weeks or even months, the corresponding permanence of the result when attained is well worth the necessary care and the waiting.

An insight into nature's processes for the relief of hernia, and therefrom a hint to the best surgical methods for its cure, may be obtained by a study of umbilical hernia in children. In infants this form of hernia is very common, frequently

occurring soon after birth, while the fibrous aperture for the passage of the arteries and vein of the umbilical cord is still open. It is often caused by ill-health which induces violent crying or coughing, though much more frequently by feeble or retarded development. In this latter case the tendinous surroundings have not fully or firmly closed about the atrophied remains of the pedicle which connected the abdomen with the umbilical vesicle of early foetal life. Thus sometimes we have umbilical hernia occurring directly after birth when the unusual size of the tendinous opening exposes the intestine to immediate protrusion. In other children in whom the tendinous opening is smaller, being so originally, or having subsequently *contracted* so as to more nearly embrace the vessels of the cord, the hernia does not occur till some considerable time after birth, perhaps not for months, though the tendency meanwhile exists. After birth the stump of the severed cord cicatrizes, the umbilical vessels become atrophied, and the tendinous opening in a healthy and well-developed child contracts about the shriveled remains of the vessels until the fibrous ring is reduced to a few lines in diameter. But if the

child's development does not keep pace with the atrophy of the vessels, and all the more if there was any flaccidity of the ring itself previous to birth, the parts are left in such a condition that from some comparatively slight cause, a hernia may protrude, and with wedge-like force gradually enlarge the opening.

If at this juncture the surgeon interferes and counteracts this opposing force by applying a bandage to retain the protrusion, then nature continues the process of contraction, and after a time the tendinous opening can be perceived to have partially contracted, and finally in many instances closes up almost completely. But in those cases where nature alone, or only thus aided, seems insufficient to do the whole work, and the hernia, because of the age of the child or other reasons, bids fair to be permanent, the idea of giving further assistance to nature's efforts, beside that of applying external support, readily suggests itself; and, if we stimulate the process of contraction by subcutaneously irritating the edges of the tendinous opening, we can see under our eyes, as I have again and again most surely witnessed, nature,

reassured as it were, resume her own work and go on to complete the required contraction.

Thus in the umbilical hernia of children the processes which nature itself adopts to restore the parts to a normal and vigorous condition, and especially some of the principles on which the success of the operation now advocated depends, can be advantageously observed and studied.

The effect produced by the irritation in this method of cure is very different from what would occur if the irritant were put into the hernial sac at its neck. There it would simply act upon opposing serous surfaces, and produce an effusion of serum or sero-purulent matter. A portion of such effusion, it is true, might consist of lymph, and cause the opposing surfaces of the sac to unite by adhesions with more or less apparent organization. The persistency of such a result, however, would be quite uncertain; and it could scarcely terminate in a trustworthy cure of the hernia. For if these adhesions should not soon diminish or disappear by absorption, the protrusion, if it could not reënter the old sac, would sooner or later force down a new one through the still undiminished or even gaping fibrous opening. If, in oper-

ating by my method, the beak of the instrument by mismanagement enters the sac, no harm is done save that if much of the irritant is deposited there, it will cause considerable pain and will certainly produce no curative effect, and is practically wasted. If by mistake the whole of the material should be deposited thus, in the interior of the sac, a cure would be quite extraordinary, and be a reversion to the old ideas of curing hernia by injection of the sac which were founded on a mistaken philosophy of the cause and of the pathology of hernia long ago exploded by experience.

After a hernia has been radically cured, the question naturally occurs, what becomes of the sac? If the hernia operated on was of comparatively recent origin, so that its sac had undergone but little alteration and contracted but few adhesions in its new position, if in short it has been found possible to return the sac to the abdomen more or less completely before operating, then the natural elasticity and contractility of the peritoneum spreads the sac over the interior of the abdominal parietes in the neighborhood of the hernial opening, and it resumes nearly the position it originally occupied before the rupture occurred.

If, however, the operation for cure was performed with the sac unreduced, the after effects upon the sac are more variable. There is still more or less retraction of the sac within the abdomen, sufficient in many cases to be clearly appreciable. In others where the neck has been transformed into a very dense ring, or where the adhesions to the spermatic cord or other organs are extensive, the retraction is not a prominent feature, and the sac slowly atrophies, closes up, and finally shrinks away to the size of a mere crowquill. This spontaneous result requires a greater or less period of time, according to the size and thickness of the sac. As the portion lying in the canal shrinks away, it of course leaves somewhat of a gap in the fibrous rings, and thus would seem to afford an opportunity for a possible recurrence of the hernia. That this does sometimes occur is quite probable, but most frequently, if the patient has not lost the tone and vigor of health, the fibres of the rings slowly close about the contracting sac, thus keeping the opening close upon it and removing all danger of recurrence of the hernia on this account.

A few words only are necessary concerning the

degree of irritation produced in this operation, so far as it depends upon the irritant itself and the after-treatment. It is desirable not to allow this irritation to go beyond a certain very moderate extent, else other tissues than fibrous may become excited, and a callus be formed, perhaps of considerable size, with little tendency towards organization, and prone either to undergo absorption, or else to result in suppuration. Moreover, the inflammation and pain would be sufficient in such event to necessitate removal of the bandages, and consequently, a practical failure would ensue, on account of not retaining the protrusion while the cure is in progress. If a little too much irritation is obtained, it can easily be controlled at the outset by applying cloths wet with spirit and water, just above the region of the upper ring. By this simple resource, it is possible to reduce the irritation to a surprising extent. The pressure of the bandage may also be moderately relaxed, but this should be done, as an accessory to the cold applications, only when imperatively required. Nevertheless, when an excess of irritation is present, it should always be considered whether this may not be due to too great a pressure at some point, as the most

common errors would probably be, either too great a pressure over the internal ring, which is easily remedied by shelving off the upper portion of the pad, or else a pressure of the pad upon the edge of the pubic bone, which should never be allowed except for some special reason, such as difficulty in retaining the protrusion.

If owing to over-caution too little irritation has been excited, it may be in a manner supplemented by undoing the bandages while the patient lies upon his back, and pressing quickly and roughly upon the rings with the finger. This favors an increase of irritation, and the canal is found to be more sensitive on the day following. But in case of unsatisfactory irritation it is the surest plan to repeat the operation after a week's interval.

In the description of the operation the average amount of the irritant employed has been stated to be ten minims. The exact amount of irritant to be used in each individual case — a particle or a drop more or less — must depend altogether upon the judgment of the surgeon, and an experience gained by following a number of actual cases throughout their entire course. Less than the average amount should be used if there has been much

previous tenderness about the rupture, though a better rule is, if a rupture is tender, to wait a while before operating, perhaps keeping the patient in bed for a few days to allow the disturbance to subside. The quantity of material used should also be graduated somewhat according to the size of the hernia, and of its opening, and of the extent of surface in the interior of the inguinal canal. In a child extremely little is necessary. There should always be enough material to spread over the surface upon which we desire to operate. The whole amount used should not be deposited at once or in one spot, but the beak of the instrument should be swept well over all the parts intended to be affected by the irritant.

I incline to the belief that there is something almost specific in the special irritant that I recommend, namely, the fluid extract of *Quercus Alba*, prepared in vacuo, strengthened by the solid extract. No other has, as far as my experience goes, been followed by a sufficient degree of success to justify its continued employment. I have tried and abandoned most of the ordinary astringents, vegetable and mineral, also various essential oils and such irritants as iodine and cantharides. With

this latter agent a moderate degree of success is attainable, and it is possible to cure some herniæ by its use. Nevertheless, it is very treacherous, often producing excessive irritation when least expected, and on this account is not trustworthy as a general agent for the purpose of curing hernia.

Although allusion has been frequently made to the necessity of much caution in practicing this method for the cure of rupture, in order to avoid inflammation, the risk in this respect is in reality a very slight one. In the first place the profession have labored for years under a groundless fear of abdominal inflammation, because they have confounded inflammation of the parietal wall of the abdomen, which is generally easily controlled and can scarcely be called dangerous, with deep-seated peritoneal inflammation of the abdominal contents. In the second place, as a matter of fact and experience, no inflammation does occur if the operation be performed with even a reasonable amount of skill. No surgeon after the experience of a few cases will be deterred from trying the operation because of apprehension of this danger, unless perchance he wishes blindly to adhere to

his preconceived ideas, and rest content with the unsatisfactory and evasive practice of treating rupture by ordering a truss. Such advice is often almost like recommending a man with a broken leg merely to get a crutch.

These observations, both theoretical and clinical, concerning the pathology of this method of treatment of hernia, must be left to others to complete. Such only are here recorded as have been confirmed by long personal experience, and therefore are felt to have a basis in truth.

Repetition of the Operation. For some herniæ the operation must be repeated in order to obtain the full curative effect possible from irritation. Those cases in which repetition is either necessary or advisable may be classed under the following heads:—

(a.) Herniæ with large openings. These are especially difficult to deal with if the opening has at any time been suddenly enlarged by violence, or by surgical interference to relieve strangulation. If in any case the opening has become enlarged chiefly at the expense of the inter-columnar fibres, and upon digital examination of the groin there is detected a marked deficiency or wasting of these

fibres, repetition is imperative. If the intercolumnar fibres are wholly destroyed, it is almost hopeless to expect that such a rupture can be made to support itself permanently without the aid of a truss. In such cases, even after treatment, a light truss must always be worn. Such a result, though in some sense unsatisfactory, may yet be very gratifying to the patient, who in all probability had previously more or less difficulty in merely retaining his rupture with a truss.

(b.) *Herniæ* where the outer pillar of the ring is much thinned and everted, or possibly appearing as if it had been partially torn or displaced from its attachment to the pubes.

(c.) In some inguinal *herniæ* where the opening at the internal ring is very patulous, the *hernia* having existed for a long while incomplete because of the extra development of the inter-columnar fibres, and on this account their unusual resistance to the passage of the protrusion. In such *herniæ*, sometimes these fibres do not stretch in regular proportion when finally the protrusion passes under them, and consequently an hour-glass appearance is given to the rupture, which is thus made to resemble two tumors or two *herniæ*.

In such a case two operations are necessary, one to make sure of the closure of the inner ring, the other to act upon the inter-columnar fibres and outer ring which should not be irritated in the primary operation.

(*d.*) In congenital herniæ there is generally more or less natural deficiency of the fibrous tissues from insufficiency of development. Hence the opening is often not closed by a first operation.

(*e.*) An old oblique hernia sometimes simulates a direct hernia in having an opening directly into the abdomen, and therefore often requires a mild preparatory irritation before the final and full amount of irritation is essayed.

(*f.*) Whenever, even in the most favorable case for operation, the effect of the irritation does not equal the expectation of the operator, the operation should be repeated. It is always a suspicious circumstance if the patient is too ready to move about and does not complain of sensitiveness in the groin, or if he shows indifference to pressure made upon the canal.

(*g.*) Repetition may be advisable in all cases wherein for any reason a recurrence of the hernia is apprehended.

In some herniæ with large openings several operations may be necessary. Where an extensive surface has to be operated upon, sometimes the effect of a small amount of irritant may be enforced by a moderate degree of scratching or scarification of the fibrous surface. It is, however, extremely doubtful whether scarification is ever of any real benefit so far as positive curative effects are concerned, and it would be perhaps as well to omit all resort to it. The process of scarification when decided upon is easily performed by using the sharpened portion of the beak of the instrument.

In repetition of the operation, when the ordinary or full amount of irritation has been produced by the primary operation, there should be a smaller amount of the irritant used than at first. This is because the fibrous parts are more susceptible than before they were interfered with at all, and it is prudent to avoid even the slightest risk of excessive disturbance. For the same reason there should always be an interval of at least several days between the operations.

A repetition of the operation is performed in actual practice in from one third to one half of all

the cases presented. Were the original operation of a severe or painful character, this so frequent necessity of repetition would be a serious objection to the general adoption of this method of treating hernia. But the surgical interference is of so trivial a character that the patient who dreaded the first operation perhaps for weeks beforehand, trusting but little to the surgeon's assurances, is easily persuaded to suffer a repetition of what he no longer fears after his experience of its mildness. The proportion of necessary or advisable repetitions is larger than it would be if the cases presented for operation were a fair selection, which in reality they never are. The troublesome and therefore difficult cases are those in which patients most desire a cure, and are willing to submit to the supposed terrors of an operation; while those persons with herniæ that can be easily managed with a light truss are apt to stay away from the surgeon, though they could be safely promised a cure by a single operation.

Upon examining cases several weeks after a primary operation, there will be found some cases in which the operation appears not to have effected the average amount of alteration, and in which

there will seem to be some probability or possibility of recurrence. Now it is not always possible to obtain the opportunity for a repetition, even if thought desirable, in these weaker cases, owing to the distant place of residence of the patient, or to his inability or disinclination to sacrifice further time to prevent a recurrence which, with the hernia apparently cured, seems to him an impossibility. And in reality, in a large proportion of such cases, the herniæ never do recur, inasmuch as the process of cure, that is to say, of further contraction and consolidation, goes on for months after operation if proper attention is given meanwhile to mechanical support. Such patients may therefore be directed to wear a light truss for a few months, and especially not to abandon the support during the warm season.

Whether any particular case requires repetition or not must be determined by the peculiarities of the hernia itself and by a digital examination of the groin subsequent to the first operation, rather than by actual experiment of the retentive strength of the parts. It is not well to take off the bandage to see whether the protrusion can be retained, for even though the process of cure may

be progressing properly the support as yet afforded by the tissues may be so weak as to allow the hernia to descend, thus stretching the fibres again ; or there may occur a partial descent or bulging of the groin, thus placing the protrusion in a position to slowly dilate the canal by wedge force. The fibrous portions retain a certain elasticity or dilatibility which disappears only after a considerable length of time, during which further contraction and consolidation occurs. Thus sometimes in the history of a case, when the hernia has slipped down behind the compress owing to over-exertion in walking or lifting, or possibly to some derangement in the bandage, it by no means is always absolutely necessary to repeat the operation, though it may be the safer alternative. Let the protrusion be at once replaced, and particular care taken that it be well retained for a few months, and it will thereafter be found in many cases that the processes of contraction and consolidation were not interrupted by the accident, and that the hernia no longer needs support. A cure in such cases would be impossible, if the dependence for a successful result could be placed only upon the existence or permanence of a callus, which pre-

vented the descent of the hernia by acting as a plug in the canal.

It is always of doubtful expediency for a patient after operation to throw off the bandage or other artificial support of a hernia during extremely hot weather, on account of the relaxing effect of the heat. This precaution should receive especial attention in all dubious cases.

It is generally more difficult to cure an omental hernia than one free from omentum. The omentum is apt to force itself partly down into the canal soon after the operation before much contraction has taken place, and afterwards to dilate the canal with a wedge force. This difficulty may be obviated by particular attention to bandaging.

Very fleshy people with herniæ tax the surgeons' utmost skill both in the actual performance of the operation, and in the proper government of the bandage afterwards. In people with a natural proclivity to obesity, this condition is often accompanied by a feeble development of fibrous parts, and the body preserves in some degree the type of infantile life. In such cases the operation is not only likely to need repetition from these inherent causes, but also is more difficult to perform

from the physical obstacle of great thickness of the fatty superficies of the abdomen. This is always thinner at the groin, yet is often thick enough even there to impede the free use of the instrument. The thick layers of fat also make it more difficult to retain the hernia by the bandage than in a thinner patient. Nevertheless all of these drawbacks may be overcome simply by attention to details. The most difficult matter with fleshy people is to maintain perfect control of the rupture after the operation. Sometimes the bandage must be abandoned, and a light spring truss with a soft pad used instead.

Application to Congenital Hernia. The distinguishing mark of this form of hernia is that the protrusion is in the same serous sac as the testicle, the hernial sac being formed of that process of the peritoneum known as the tunica vaginalis. The descent of the testicle usually occurs about a month before birth, and the closure of the tunica vaginalis should soon follow, though in many cases this channel between the abdomen and the scrotum still remains open at birth, or even long afterwards. But unless there also exists a weakness or deficiency in the fibrous surroundings of

the rings, a hernia does not necessarily occur, though the tendency is to produce the congenital form if any. Hence the presumption that a scrotal hernia in a child is probably congenital. Lawrence pertinently observes that "in quadrupeds the tunica vaginalis communicates with the abdomen and yet protrusions of the viscera are rare. The term congenital, therefore, is not applicable to this hernia in its strict sense, as it does not usually exist at the time of birth." The formative deficiency in the fibrous tissues is a frequent accompaniment of nonclosure of the tunica vaginalis, which is itself a mark of feeble development, and in many congenital herniæ of long standing the lack of fibrous surroundings is so marked as to greatly diminish the probabilities of cure. The operation upon a simple congenital hernia is practically the same as upon ordinary oblique hernia, and would require but little notice were it not for the very common complication of being almost invariably accompanied by an undescended or partially descended testicle. But this obstacle rarely precludes the possibility of successful treatment. If the testicle has descended so far as to lie below the crest of the os pubis, it can easily be confined

there by a compress pressing against the bone just above the testicle. If the testicle lies slightly above the bone, it may still be possible by manipulation and bandaging gradually to force the testicle down into the desired position. If it is impossible to withdraw the testicle from the abdominal ring upon which pressure must be made after operating, the only means of treatment consists of an excision of the testis, which in such cases is usually of little or no service to the patient on account of its soft anomalous state of development. After removal of the testis the hernial opening can then be closed almost completely, as its function has ended, and in this respect it is analogous to the umbilicus.

The objection to returning the testicle to the abdomen, and then effecting a closure of the opening, is that the testis displays so strong a tendency to descend and redilate the opening that a permanent cure could scarcely be expected. Moreover, if shortly after operating for the cure of congenital hernia the testis should slip up behind its compress and enter the abdomen, the results are apt to be unsatisfactory for the reason just stated. Particular care is always necessary to prevent this

accident during the day or two following the operation, especially if the testicle is of small size. It is always prudent, previous to operating, to allow the patient to go about for a day or two with the bandage applied, so as to be certain that we shall be able to hold the testicle in proper position, and also to accustom it to its new location.

Application to Umbilical Hernia. Umbilical hernia in adults, and in all cases except those of young children, is to be treated for cure on the same general principles as inguinal hernia. The method of tendinous irritation meets with unexampled success in this variety, the percentage of cures exceeding even that in oblique inguinal hernia. This is partially due to the greater aggregation of fibrous fasciculæ which encircle the umbilicus, and partly also to the fact that the function of the umbilical ring as a natural opening giving exit to an important organ ends soon after birth, so that nothing hinders the complete closure of the fibrous ring.

The opening of an umbilical hernia is usually at the upper part of the tumor if the hernia has attained any considerable size. It is usually through the umbilicus itself, rarely extending a

little downwards along the linea alba. The peritoneum is much more closely attached in the neighborhood of the umbilicus than in the inguinal region. Hence the hernial sac is very much thinner in umbilical than in the other varieties of rupture, and is often inseparably blended with the integument and fasciæ over the greater part of the tumor. Nevertheless at its neck the layers can always be separated. It is therefore necessary to perform certain preliminary manipulations before attempting the operation for cure. Having placed the patient upon his back and reduced the protrusion, a portion of the integument and sac close to the neck is then to be pushed directly through the opening with the forefinger and pressed deeply in. If this cannot be done without doubling or folding the inner or fibrous sac, it is because of adhesions between the edges of the fibrous ring and the sac. These are generally slight, and can be easily ruptured by manipulation. If necessary these attachments may even be dissected away subcutaneously. The manipulating about the ring often causes considerable pain, as there appears to be a peculiar sensitiveness of the ring in umbilical hernia.

If this process of freeing the edges of the opening has been accomplished without much trouble, the operation may be proceeded with at once. But if much manipulation has been necessary, or if there is very much sensitiveness about the opening, it is better to wait a few days before operating.

This adherence of the neck of the sac to the edges of the aponeurotic opening is not wholly confined to umbilical hernia, but is found occasionally also in inguinal or crural hernia, being caused usually by the truss bearing too strongly upon the hernial opening, or by some one of the so-called "radical cure" trusses with their almost barbarous pads pressing into the opening, or in some way exerting undue pressure upon the parts. If such a hernia subsequently increase in size, the sac may become thin and frayed owing to the distention, — the peritoneum being prevented from descending further by the adhesions at the ring, — and we thus have a condition somewhat resembling the ordinary state of an umbilical hernia. In treating such cases, efforts must be made subcutaneously, as directed above in umbilical hernia, to detach the neck from the aponeurotic opening. If the

attempt to free the ring is unsuccessful, nevertheless the operation may be performed by introducing the beak of the instrument into the neck of the sac and puncturing it from within outwards, depositing slight amounts of the irritant in several places between the sac and the fibrous tissues of the rings and canal. The injury done to the sac is of little account and the only objection to this procedure is that the irritant cannot be distributed as freely as it ought, and there is greater risk of an excess of irritation.

In the performance of the operation upon umbilical hernia the integument of the sac is pressed into the opening as described above, and the beak of the instrument is made to penetrate the integument by the side of the finger. The nozzle is then passed around and just behind the fibrous edges of the ring, while slowly delivering the irritant. If the serous hernial sac is punctured in one or more places in accomplishing this maneuver, — an accident which may readily occur on account of the thinness of the sac, — or even if some of the irritant in any way gets into the interior of the sac or its mouth, no great harm is done, though such an accident should be avoided

if possible on account of the proximity of the intestine. In children especial care should be taken to avoid any disturbance which might arise from thus misplacing the irritant; and a very small amount of material is generally sufficient to effect a cure in young patients. The essential point in any case is that the quantity sufficient for irritation shall be applied just within and to the edges of the fibrous ring itself. If applied elsewhere it has no curative effect. After introducing the irritant, the protrusion should on no account be allowed to descend, and an abdominal bandage and compress should be fitted at once. The after-treatment is the same as in inguinal hernia.

The linea alba extends from the ensiform cartilage to the pubes, and is formed of dense white fibrous tissue which is derived from the aponeuroses of the abdominal muscles. The tendinous fibres of these aponeuroses are continued from side to side in a decussating manner. A little below the middle of the linea alba, where it is crossed by one of the lineæ transversæ, is a round flat space, in the centre of which is situated the umbilical opening, or more properly, what was such at birth. The fascia transversalis is not so strongly devel-

oped over the umbilical region as in the neighborhood of the groin. Nevertheless, the relation the fibres bear to the umbilicus is very significant. They bend about it as a bowstring bends around the arrow when drawn to the head. (See Fig. 7.)



FIG. 7. TRANSVERSALIS FASCIA AT THE UMBILICUS, after R. Froriep.

1. Umbilicus. 2. Transversalis Fascia.

It is probable that many cases of umbilical hernia occurring primarily in adults are due to a predisposition engendered in early life by the imperfect closure of the umbilical fibrous opening. When later in life pregnancy or obesity occasions an additional strain upon the imperfectly or feebly closed ring, the rupture occurs.

In infants, or children under five years of age, umbilical hernia needs merely to be supported by a bandage provided with a small flat pad, and in

the majority of cases a spontaneous cure results without further interference. But after a child is four or five years old it is rarer to obtain a cure from wearing a truss, and a slight operation is generally necessary to induce further contraction.

Application to Femoral Hernia. In operating upon femoral hernia it is always essential to first clearly define the position of the saphenous opening, which is usually dilated in an upward direction if the femoral hernia has completely emerged from the femoral canal. This opening can, in most cases, be readily located by making firm pressure in the thigh with the finger a little below Poupart's ligament and less than an inch to the inner side of the femoral artery. There is a lymphatic gland lying directly over the saphenous opening which can be distinctly felt, and all the more readily if, as is generally the case, it has been enlarged by the constant pressure of the truss. Also, in most cases, the firm, sharp edge of the falciform process of the fascia lata, perhaps thickened and hypertrophied by the friction of both the truss and the hernia itself, will be felt above and to the outer side of the opening, forming a most important landmark. Its curve is so peculiar as to be almost unmistakable.

The actual performance of the operation is in many respects similar to the operation on inguinal hernia. The patient is placed on his back with the lower limbs extended. The left forefinger together with the integument is forced as much as may be into the opening. The enlarged lymphatic gland is thrust to one side, and also the hernial sac if it has been found impossible previously to reduce it. The forefinger is kept firmly pressed against the outer edge of the falciform process. The beak of the instrument is then quickly inserted into the canal above the saphenous vein and to the inner side of the femoral vein which is pressed away by the finger. It thus enters the femoral canal exterior to the hernial sac. It must be remembered that the femoral vein often lies partly behind the hernial sac. Once having entered the femoral canal, the irritant is deposited on the same principles that governed its distribution in the inguinal canal. But little irritation should be applied at the crural ring, and a femoral hernia always requires a smaller amount of irritant than an inguinal hernia of the same size.

After the operation a bandage and compress

should be applied similar to that described under inguinal hernia. It should be adjusted, however, so that the pressure of the compress is more directly backwards or inwards. Also when the patient is first allowed to walk about it is well to substitute for the bandage a spring truss with a short neck which is fixed almost at a right angle with the spring. A truss is preferable in the after-treatment of femoral hernia, because it is so difficult, and in many cases impossible, to maintain pressure with a bandage that is sufficiently firm and deep. A truss is also advisable because it is generally necessary for the parts after the operation to receive some support for a longer period than in a case of inguinal or umbilical hernia.

On account of the greater rigidity of the parts surrounding the femoral canal the operation by irritation is not so largely successful in curing this as other forms of hernia. The rigidity is especially marked at the crural ring, and enforces upon it a peculiar form of enlargement. In front of the ring are the femoral arches, behind is the hip bone, supporting the pectineus muscle and the pubic portion of the fascia lata; to the inner side,

Gimbernat's ligament, the conjoined tendon, etc. ; to the outer side, the femoral vein, from which it is divided by a septum. If, then, the crural ring has been much dilated, it is at the expense of the fascia which extends from the insertion of the internal oblique to the iliac vein and lies in front of the hernial sac. If the hernia is a small one, a portion of this fascia still remains, but if it is large, these fibres are almost wholly destroyed excepting a portion lying between the femoral vein and the sac, and forming a part of its septum. For this reason it is frequently impossible to obtain an efficient contraction of the upper aperture or crural ring, and reliance must be placed solely upon the thickening and contraction of parts below. Though this may be successfully accomplished, yet inasmuch as there is left a depression above, the protrusion obtains more or less leverage, and may result in re-dilating the canal and in reproducing the hernia. It is therefore advisable, as has been stated above, to wear a light truss after operation until the fibrous tissues have perfectly consolidated and the changes in their structure have become permanent. To accomplish this result requires several months.

Although the method of tendinous irritation is less applicable to femoral than to other ordinary varieties of hernia, nevertheless the proportion of successful results is amply sufficient to warrant the performance of the operation. The cure of any kind of hernia is always a delicate operation, but to operate upon femoral hernia successfully requires especial skill; and it should not be attempted except by practiced hands on account of the very important organs which lie so close to the hernial sac.

Ultimate Results. In regard to the proportion of successful results after this operation, I can only say that in my own cases the percentage of permanent cures has been very flattering, much higher perhaps than would be generally accredited if I should attempt to state it precisely. Even were I desirous to do this, it would be impossible to give other than a mere estimate, on account of the great difficulty of learning the ultimate history of more than a portion of my patients whose residences are scattered over the country. What success others may meet with I can only imagine, but I am confident that unless they devote considerable attention to the subject, or, in other

words, become specialists on hernia, they will never acquire that delicacy of touch, and skill in overcoming the difficulties of each particular case, which are requisite for the largest possible success.

But whatever may be the worth of the operation as a means of cure, there is one very important consideration to be deduced from the many hundreds of cases in which I have operated by this method. It is a strictly *safe* operation. I have never yet had a fatal case, and with due care one is not likely to encounter any untoward results. This is more than can be said of any of the other operations which have been proposed for the cure of hernia, some of which are still recommended, though feebly, in the standard works on surgery.

CHAPTER III.

IRREDUCIBLE HERNIA.

A HERNIA is said to be irreducible when the protrusion, or at least a part of it, cannot be returned to the abdomen. The nutrition and functions of the parts involved are not arrested to the extent that obtains in strangulated hernia. Though no stricture usually exists, still the patient is exposed to much greater risk of intestinal derangement than if the hernia were reducible.

The patient will almost always remember a time when the tumor could be returned to the abdomen, and thus confirm the diagnosis of hernia, while the essentially chronic character of the symptoms, both objective and subjective, will indicate the condition to be that of simple irreducibility, and not of strangulation. Sometimes, however, a rupture is irreducible from the outset, especially in those persons in whom it has been produced suddenly

during violent muscular effort, or has been caused by a kick or blow. It is very common also for a previously existing reducible hernia to become irreducible when the protrusion has by any means been forced down to a greater extent than usual. Again, an ordinary hernia may be inefficiently retained, because of the wearing of a truss which allows the hernia to descend into its sac, or sufficiently so to enable it to contract adhesions about the neck of the sac. After a length of time, variable in different persons, these adhesions become contracted and toughened, and thus prevent the reduction of the protrusion. Sometimes no adhesions are formed, but the protruded mass, especially if it consist of omentum and is retained with difficulty by a truss, becomes so enlarged by deposits of fat in its fundus that it cannot readily return by the opening through which it originally descended. Sometimes, again, membranous bands form, dividing the cavity of the sac into partitions, making it appear as if there were several herniæ existing at once. Or these bands form exterior to the sac, and stretching across it, bind it firmly down. Or, the irreducibility may be due to thickening and contraction in the neck of the sac itself,

following inflammation, or produced by the irritation of a too powerful or a badly fitting truss.

Whenever a reducible hernia has been rendered irreducible by any sudden process, there is considerable probability of inflammation attended by more or less of the active symptoms of strangulation, such as vomiting, colic, obstinate constipation, etc. But unless a stricture is produced, as in true strangulation, the symptoms gradually subside or assume a chronic form, and the hernia remains irreducible. It is true that a strangulated hernia is always irreducible as well; but by common consent strangulations are set apart by themselves inasmuch as they imperatively require speedy and special treatment; and by the term irreducible in these pages is always intended the chronic form uncomplicated by strangulation.

Irreducible herniæ are naturally divided into three classes, according to the nature of the hernial protrusion; namely, epiploceles, enteroceles, and entero-epiploceles.

Epiplocele. This is the most frequent of the three varieties. In this form the protrusion consists wholly of omentum, which is easily detected by its peculiar doughy feel and more or less irreg-

ular form. It is quite common to meet with irreducible epiplocele in femoral herniæ, particularly in women, who as a sex are prone to this variety. Women are inclined, also, to conceal for a long time the existence of a rupture through delicacy, or by being led to attach little importance to their trouble on account of the ordinarily small size of femoral ruptures when confined by the dense tissues surrounding the crural canal.

After a femoral epiplocele has once emerged from the saphenous opening it may attain almost any size, and it is not rare to find such as large as an orange. Often therefore when a femoral epiplocele is presented for examination it is found to have contracted adhesions and to be irreducible. Moreover, this result is often due not so much to the reticence of the patient as to the extreme difficulty of efficiently retaining a femoral hernia by the trusses ordinarily used for that purpose. These trusses are usually merely *small* inguinal trusses with too long and too straight necks and too broad pads to be really suitable for femoral hernia. In the way they are commonly applied, if the spring is strong enough to press well into the femoral region, the compression upon the femoral vessels is

apt to be so great as to be uncomfortable. Usually, therefore, in practice such trusses are supplied with only a weak spring, and in consequence they retain the protrusion so imperfectly that they are frequently worn with the omentum partly or wholly protruding. For omentum alone in a rupture will bear considerable pressure without much manifestation of inconvenience on the part of the patient, and hence it is not uncommon to meet with persons, whether men or women, who are wearing an ordinary truss compressing the neck of an irreducible epiplocele, while the bulk or body of the tumor hangs below the pad. Also, on account of this tolerance of pressure it is evident that epiplocele will permit the use of greater force and severer handling in the effort at the taxis than either enterocele or entero-epiplocele.

The subjective symptoms of an irreducible epiplocele are much less severe than in an irreducible enterocele or entero-epiplocele. There often occur peculiar dragging sensations, together with general weakness and inability for exertion. Particularly if any bowel insinuate itself into the protrusion,—an event whose possibility constantly threatens the patient,—constituting for the time being an en-

tero-epiplocele, the symptoms of general distress become aggravated if not alarming, until relieved by the return of the intestine to the abdomen.

Irreducible epiploceles, as well as irreducible herniæ in general, are especially liable from their exposed situation to injuries from external violence, causing inflammation and fever with symptoms of local peritonitis, but, unless intestine is present in the protrusion, there is not usually any obstinate vomiting or any obstruction of the bowels.

The tumor of an irreducible epiplocele always tends to become larger with lapse of time, both from the natural tendency of the omentum to grow by accumulation of fat in its tissues, and by the gradual descent of more and more of the omentum from the abdomen on account of the difficulty of adequately supporting the rupture. If by any means the protrusion has been suddenly forced further down, it may become constricted, and strangulation may ensue.

Enteroccele. In this variety the protrusion consists of bowel alone, and it is much more rarely met with in a simply irreducible state than either epiplocele or entero-epiplocele. Undoubtedly the

reason is, that, though this lesion is really of quite frequent occurrence, inflammation usually sets in so soon that such cases are reckoned among the strangulations, and operation is resorted to forthwith. Occasionally, however, a patient will be found in whom an irreducible enterocele has existed for some years. Such a case is usually accompanied by symptoms of gastric disturbance with frequent attacks of nausea, colic, and general distress combined with more or less derangement of the bowels. The patient is practically a permanent invalid unfitted for bodily exertion, and is compelled to exercise the greatest care to keep the bowels regularly open on account of the constant risk of their obstruction.

Entero-epiplocele. This variety is less frequently met with in an irreducible state than epiplocele, though much more common than enterocele. Moreover, even in an entero-epiplocele, it is usual to find that the omentum is the only absolutely irreducible portion. Whenever the bowel also is irreducible, the symptoms of general distress are more marked and more frequently recurring. In some cases, however, after an attack of incarceration, the intestine also becomes

adherent, and the symptoms more or less resemble those of an irreducible enterocele.

Treatment of Irreducibles. The treatment of a chronic irreducible hernia is either palliative or curative. The palliative treatment consists in supporting the protrusion as much as possible either by means of a laced bag or suspensory bandage, or by making use of a scoop or hollow-padded truss, the pad being fashioned as nearly as may be to the shape and size of the tumor. This merely "put-off" or evasive treatment is always found in practice to be extremely unsatisfactory. It is almost impossible to prevent increase in size of the rupture, or a further protrusion if the patient continues to lead a life of activity, and the malady is quite likely, indirectly if not directly, to be the ultimate cause of death. Such was the fate of the historian Gibbon, who had an irreducible hernia reaching nearly to the knees.

The curative treatment of irreducible hernia consists in its conversion into the reducible variety by manipulation, if possible; or, if not, by surgical interference. For the past thirty years it has been my habit to recommend for this affection active curative measures which I have never seen

cause to regret. Once converted into the reducible variety, the patient can then keep up the hernia with an ordinary truss, and get into a good condition for an operation for a radical cure which will relieve him altogether of the necessity of wearing any support whatever in the inguinal region.

The manual means employed to return any hernia, reducible or irreducible, to the abdomen is known as the *taxis*. In trial of the taxis the patient should be placed on his back with the lower limbs flexed in order to relax the muscles and fasciæ as much as possible, and thus not only increase the size of the rings, but also add to the receptive capacity of the abdomen. The surgeon takes his position upon the right of his patient, and grasping the tumor with his right hand makes gentle pressure upon it, directed, in the case of oblique hernia, towards the anterior superior process of the ilium; meanwhile he takes the neck of the tumor between the thumb and forefinger of his left hand, and by moving the mass from side to side endeavors to disengage it so as to get first a small portion and then the whole of the contents within the abdomen. In an ordinary irreducible

hernia there is none of that danger attending the use of the taxis that is encountered in dealing with inflamed or strangulated hernia, and the efforts may be prolonged if necessary for half an hour or an hour, and in cases of epiplocele a considerable degree of pressure may be safely exerted. It is always very difficult to determine that a hernia is absolutely irreducible. This conclusion can only be justified after a patient persevering trial of the taxis, by a skillful hand, continued for at least several days in separate sittings of a half an hour or more each.

The most frequent cause of the irreducible epiploceles that in actual practice come most frequently into the specialist's hands, is either imperfect retention by the truss, or else total neglect of all attempt at support. It is almost impossible for any one, even though supplied with a proper truss, to perfectly retain an epiplocele through a long period of years, and though a hernia does not necessarily become irreducible simply from not being retained, provided only care is taken occasionally to return the protrusion (and it is remarkable how skillful many persons become in practicing the taxis upon themselves), still it is quite

likely, if unsupported or imperfectly retained, to contract adhesions which hinder or prevent its reduction. How long a time may be required for adhesions to form and acquire such a degree of strength that they cannot be broken up by successive trials of the taxis, depends upon the nature of the case, and varies greatly in different individuals. For a while after their formation the hernia may be said to be only apparently irreducible. In many cases long continued pressure will break up the adhesions. The forefinger, invaginated in the scrotal tissues, can frequently be insinuated within the inguinal canal and then be slowly yet forcibly swept around the neck of the sac, thus effectually disengaging it and breaking up all attachments. In some cases, where the sac is not yet much thickened and developed, the sac itself can be thus invaginated and the finger pass to a certain extent between the interior of the neck and the protrusion.

Sometimes the hindrance to reduction is not so much the formation of adhesions as the existence of an unusually small hernial aperture, guarded by pillars more powerfully developed than ordinarily, and held together by strong arci-

form fibres. This is especially the case in men of the American type, with a paucity of muscular development and an inordinate proportion of bone, joint, and fibrous tissue. A similar difficulty is also experienced where the epiplocele has been for a long time unreduced. The omentum when continuously protruded is very apt to become increased in size by the deposition of fat within its tissue, while at the same time it gradually becomes constricted into a narrow cylindrical shape at the hernial opening and canal. In cases where this process has been long established, we find the ring plugged by a cylinder of omentum and hypertrophied vessels, while the portion exterior to the ring is spread out like a mushroom. When, therefore, the obstacle to reduction appears to be merely the small size of the hernial opening, the omentum, if also of small size, can frequently be returned if the ring can be slightly stretched or enlarged. This enlargement I have sometimes accomplished in the following manner in cases of inguinal hernia, viz. : by invaginating the finger in the skin of the scrotum and insinuating it into the hernial aperture, then, hooking the finger, I succeed in dilating the ring by pressing forcibly upon

both of the pillars alternately. The dilatation should never be extensive, nor be attempted at all, if the omentum is of considerable size. The proceeding also renders more difficult a future radical cure of the rupture. Nevertheless it is a resource of great value when used judiciously.

In a few cases of small omental herniæ where the pillars of a narrow ring could not be separated by the above method, I have ventured to slide a very small tenotomy knife along the side of the invaginated finger, and, keeping the knife at first flat against the finger, then turning its edge upwards, have made a slight cut through the skin and nicked the opposing fibrous tissues. On withdrawing the finger the wound is invisible in the loose scrotal integument. This incision must be minute and made with the greatest care, as the ring is made very tense by the invagination of the finger.

It is worthy of observation, as it is perhaps contrary to general expectation, how little inflammation or other local disturbance is produced in the great majority of cases by these, perhaps, unusual efforts to assist the taxis, as well as by the persistent trials of the taxis itself. The reason, proba-

bly, is that these various lesions are subcutaneous. The efforts at forcible dilatation are painful to the patient, and should be tried, for the purpose of making a final attempt at the taxis, only when he has been etherized.

It is an important question in every case to decide how long the surgeon is justified in trying to effect a reduction of the hernia by the external pressure of the taxis. To this it may be safely answered in general, that so long as the patient experiences but little pain from the manipulations, they may be persevered in, and may be even longer continued if the surgeon meets with some partial success to encourage him. The trial should never be given up until anæsthetics have been resorted to, nor until the taxis with inversion has been attempted. By inversion is meant the elevation of the hips and lower extremities, while the head and shoulders are kept dependent, so that we have the force of gravitation in addition. If at the same time the spinal column is bent, the abdominal muscles are completely relaxed, and the opening at the ring is in a most favorable condition for successful reduction.

When fluid is present in the sac of an irreduci-

ble hernia, it can be withdrawn by a needle trocar if thought advisable. If the amount of fluid is not excessive its presence is often of assistance in the efforts at taxis, as it serves to dilate the hernial opening after the analogy of the amniotic fluid in labor. But if the adhesions about the neck allow the fluid to pass freely into the abdomen, the surgeon should remember that it is not always quite safe to allow an effusion of long standing to enter the abdomen. If the fluid is of a merely serous character, caused by the protracted trial of the taxis, it is quite harmless.

It may be observed, also, that it is by no means always advisable, even if possible, to return a large mass of omentum to the abdomen by either the taxis or subcutaneous operation, inasmuch as it is apt, especially if much altered in structure, to act like a foreign body. In my earlier practice, owing to a fear of amputating large masses of omentum, I returned in several cases large portions to the abdomen, but so much colic and general distress were produced that I was obliged to remove the supporting bandages, and to suffer the omentum to come down again into its old sac.

By means of the simple taxis, patiently persevered in, I have, in many cases, succeeded in reducing herniæ which had been apparently irreducible for five, ten, or even twenty years, and more. But notwithstanding all efforts at reduction, and all the artifices we may adopt to assist it, there will always be left a large percentage of cases which remain obstinately irreducible. Now what shall the surgeon do in these cases? If the patient suffer little or no inconvenience from the hernia, which however is hardly supposable, further treatment can be avoided if he will wear a laced bag to prevent further descent. If, however, not only inconvenience but a good deal of pain attends the hernia, so that it becomes the source of constant and harassing vexation, not to say alarm, even though no real immediate danger menaces the patient, is he to have no relief from surgery? The standard teachings hitherto on the subject hesitate or refuse to offer any further aid than the unsatisfactory scoop truss. For my own part I have been in the habit for many years of resorting to the knife, making a small incision into the sac, dissecting away the adhesions, and returning the protrusion, or a portion of it, to the

abdomen. My experience through many years, as shown in the cases appended to this chapter, has proved that this operation is safe, trustworthy, and efficient, and no more to be dreaded than any other surgical operation of moderate importance.

Statistics have been published on strangulated hernia establishing the fact that the earlier in the history of the case surgical operation is resorted to the greater is the likelihood of a successful result.¹ Now all the operations for strangulation are necessarily performed upon inflamed and irritated tissues whose nutrition has already been suddenly impaired, and which are ripe for peritonitis if exposed to external influences. Most surgeons agree in laying the blame of their failures in strangulations to this prominent fact. But how different is the condition in a hernia that is merely irreducible. Here neither the circulation nor the nutrition of the parts is dangerously interfered with, and they are in a healthy, though anatomically abnormal, state; consequently, the actual liability to dangerous inflammation or peritonitis in the operation by the knife for the reduction of an

¹ See Mr. Haward's paper, *St. George Hospital Reports*, vol. i., p. 124.

irreducible case is really very slight, and by no means sufficient to deter a skillful surgeon from advising and attempting this means of relief. In this opinion of the slight risk of inflammation I am happy to be confirmed by so high an authority as Professor Wood, from whose treatise on rupture the following is quoted, being intended by him to justify his operation on hernia: "On reading over the opinions of modern writers on hernia one cannot but be struck with the importance they attach to the supposed dangers of meddling with the peritoneum and its offsets. Around this theory are grouped most of the objections to operative interferences. The theory alluded to seems to have been deduced from experience of operations performed upon this membrane in a state of disease or inflammation, or operations exposing it extensively to external influences. Hundreds of operations implicating the healthy peritoneum, both upon herniæ and under other circumstances, without bad results, have been overlooked or ignored. This prejudice is, I believe, at the bottom of most of the objections, as it formerly prevailed against early operation in cases of strangulated hernia. In the latter cases it seems to have gen-

erally given way, rendering it more easy to be dealt with in the former class. In a general way, inflammation of a parietal portion of the peritoneum has been confounded with that of the visceral layer, or general inflammation of the cavity near the important nervous centres. A secluded portion has been invested with the attributes of the whole, a logical error not uncommon."

Considering, therefore, the many dangers to which a person with irreducible hernia is subject, whether from external violence, or from the great size which the tumor is apt to attain if allowed its own course, or from the liability of the omentum to become diseased; having in view also the lesser inconveniences, and the constant liability to obstruction, or strangulation upon further protrusion, the operation for relief seems not only justifiable but advisable. In very old persons, or in those of feeble health, such a proceeding may be deprecated, but in the majority of patients a successful result is as assured as in any surgical operation of importance.

In operating to reduce a common irreducible hernia, we have one great advantage over the somewhat similar operation to relieve strangula-

tion. We have no stricture to deal with. Hence, after cutting down upon the protrusion and opening the sac, we can usually at once return the contents to the abdomen. If adhesions are present at the neck they can be broken up by the finger or by the handle of a scalpel. This freedom from the necessity of dividing a stricture not only much diminishes the supposed risk of peritonitis, but enables us to avoid injuring the fibrous structures about the ring. When omentum makes a part or the whole of the protrusion, it is well to return it through the ring, provided it be of small size and has not undergone much alteration of structure. It is, however, of very doubtful utility to enlarge the ring to any great extent for this purpose, because the probabilities of success in a future operation for radical cure are thereby diminished. Moreover, a piece of protruded omentum of large size has nearly always become so much hardened and altered that there is considerable risk in returning it to the abdominal cavity where it may act like a foreign body and cause much disturbance. It is much better in such cases to remove the omentum altogether. Omental tumors of long standing are large at the lower part or fundus, while at the

hernial aperture they are condensed into a small neck. This neck may be transfixed at the external ring, or just within it, by a needle carrying a double thread, ligated by two or more ligatures, and cut off immediately below. I have found no harm or apparent physiological effect whatever resulting from this excision of omentum, even though the mass removed has sometimes been very great, amounting to several pounds in weight. The ligatures separate after about two weeks or more, the external wound, which should always be made as small as possible, granulates and heals, the scrotum or other integumental pouch gradually contracts, and the hernial sac proper is retracted and absorbed, until finally a slight scar is the only trace left of the formerly troublesome and irreducible mass.

Sometimes the protruded omentum is not found condensed into a small neck as above stated, but is gathered or puckered together much as a piece of flannel might be if passed through the canal and then spread out again above and below. This condition may obtain even in large protrusions of long standing, and merely necessitates the use of a greater number of ligatures.

In some cases of irreducible femoral hernia the omentum, though small, is much altered in structure, and is contained in a very thick fibroid sac. In such cases the needle may be passed directly through the neck of both the fibroid sac and the omentum, and ligation made upon the two together. The only objection to this is the longer time required before the ligatures are released; but it usually results in such a cure of the hernia, as to require only a light truss to be worn afterwards. There is always a certain amount of retraction of both the sac and the stump of the omentum soon after ligation.

An irreducible hernia should never be operated upon in a state of inflammation or irritation from whatever cause. The surgeon should order rest and cold applications until the inflammation is allayed.

Whenever an irreducible hernia has been converted into the reducible form by the taxis or by any operation, whether subcutaneous or otherwise, no attempt should thereafter be made to operate upon it for a radical cure until sufficient time has elapsed for all symptoms of inflammation or irritation to have completely disappeared. After the

excision of omentum several months may be required; after a successful though prolonged trial of the taxis, several days or perhaps weeks. This delay is also prudent even after the ordinary reduction by taxis in order to become assured that the patient is not likely to suffer any difficulty or inconvenience in keeping the protrusion within the abdomen.

In the appended list of cases the reader will notice that none are chronicled wherein there has been a fatal result. Not having met with any such, I have none to offer, nor in my experience of over thirty years have I met with after-symptoms which caused me much apprehension, or led me to think otherwise than, as above stated, that the operation for the reduction of irreducible hernia by surgical means is safe, trustworthy, and efficient.

OPERATIONS ON IRREDUCIBLE HERNIA.

CASE 1. During the month of June, 1844, Mr. D., aged forty-one years, of thin habit of body, consulted me for irreducible femoral hernia of both sides. That of the right was of about the size of a butternut, and had been irreducible for twenty years. He had worn a scoop truss a part of the time, and had been a great sufferer. To my surprise, I

was able to reduce this hernia by the taxis, continued for about half an hour. I immediately operated on it for a radical cure. The hernia on the left side had not been irreducible so long as the other, but I found it impossible to reduce it by the taxis, though the effort was made in successive sittings, and therefore resorted to the operation with the knife. The contents of the tumor proved to be omental. A portion of this I removed, as it had increased in size so much as to render it impossible to return it to the abdomen.

In this case, and in the one following, I did not, as I have since done, ligate the neck of the protruded mass before removing it. At first a slight hemorrhage took place which, however, I stopped by applying lint and a firm compress. On being called to see him a few hours after the operation, and removing the dressing and opening the wound I found that a secondary hemorrhage had taken place. The stump had been drawn up out of sight by the retraction which always takes place after amputation, and I found it impossible to get at the bleeding vessels. As my only resource, therefore, since the hemorrhage was threatening the patient's life, I plunged a slightly curved needle, armed with a strong ligature, in at the base of the wound directly under Poupart's ligament and brought it out above the ligament through the integuments and tied the two ends of the ligature over a roll of cloth, thus enclosing the cut end of the omentum. This checked the bleeding, after which no further unpleasant symptoms occurred. I removed the ligature in about thirty-six hours. The patient recovered speedily.

CASE 2. In September, 1844, Miss N., aged twenty-three

years, of large, stout person, consulted me for an irreducible femoral hernia of two years' standing. The irreducible portion was of the size of a walnut. She had worn a truss for a long time which had given her but little relief. Being unable to reduce this hernia by taxis, by the patient's wish I operated on it with the knife. I found the hernia to be omental. Strong adhesions had formed, which were broken up with difficulty. Finding that it was not practicable to return the mass protruded, I excised it, without, however, ligating it beforehand. In this, as in the preceding case, a free hemorrhage took place from the ends of the cut vessels, and as the portion of omentum remaining naturally retracts after the excision is made, I found it difficult to get at the vessels to ligate them; nevertheless, I finally succeeded in doing so, and in arresting the hemorrhage. Having learned wisdom from my experience in these two cases, I have since always transfixed and ligated the neck before excision, and have found that the only detrimental result is that the presence of the ligatures delays somewhat the speedy closing of the wound. To ligate omentum, however, is contrary to the teaching of Sir William Lawrence in his treatise on Rupture, and it was in deference to him as an authority at the time (1844) of this operation, that I omitted to ligate in these cases before amputation.

CASE 3. In September, 1846, Miss H., a maiden lady, aged thirty-five years, of spare habit, came under my care with an omental femoral hernia of two years' standing. The omentum had been irreducible for from six to eight months. During this time she had been able to do but little work,

and had suffered much from attacks of colic which could with difficulty be relieved. Finding it impossible to effect the reduction by external pressure, I performed the operation described in the previous chapter. On cutting down upon the tumor, I found strong adhesions existing between the sac and the omentum. These were very difficult to break up, as is frequently the case in femoral hernia, but after they had been carefully dissected away, and a slight enlargement of the ring had been made, the reduction was readily effected. A radical cure followed without any subsequent operation.

CASE 4. In October, 1846, Mrs. K., aged forty-five years, of robust person, consulted me for an omental inguinal hernia of the left side of sixteen years' standing. For nine years it had been irreducible. She had worn a scoop-truss with but little relief, had been unable to walk during a part of the time, and had finally become much broken down by her sufferings. As there was apparently much water in the sac, which would tend to prevent the formation of adhesions, I concluded to perform the subcutaneous operation with a delicate tenotomy knife. This I did, and upon slightly enlarging the ring, the protruded mass was slipped suddenly back with a gurgling noise, indicating the presence of intestine as well as of omentum. I afterwards operated upon this patient for a radical cure, both on this rupture, and on a reducible femoral hernia on the other side, meeting with success in both cases.

CASE 5. In January, 1847, a single lady living near Boston, aged about thirty years, very delicate and of spare habit

of body, was placed under my care. She had been troubled for about two years with an irreducible femoral hernia of the right side, the size of a pullet's egg, and, not being willing to make her case known, went about without any external support to the parts. Her severe suffering at irregular intervals with colic pains, nausea, constipation, etc., finally compelled her to take to her bed and send for her physician, who advised her to wear a hollow-padded truss, after he and others had vainly tried to reduce the protrusion. This she was unable to do on account of the irritation and soreness which it produced. She was therefore compelled to take to the bed, losing flesh and strength daily. In this condition I found the patient. Upon making an examination, I found the swelling quite hard and inelastic, and therefore supposed it to consist of omentum. After a protracted series of efforts with the taxis without success, I decided to cut down and dissect away the adhesions in order to return the protrusion. The incision was made near Poupart's ligament. On coming upon the omental portion of the tumor it was found much altered in consequence of adhesions of a strong cartilaginous nature running in every direction and binding the different portions of the protrusion firmly together. These adhesions were carefully separated and divided fibre by fibre with the scalpel till I reached the crural ring which was incised directly upward, and the reduction accomplished, though after considerable exertion. Bandages were applied, and the patient kept in the recumbent position. The recovery in this case was sufficiently rapid, though with my present experience I should, in a similar case, remove the omentum

instead of returning it to the cavity. An operation was afterwards performed on this patient for a radical cure, which was successful, and in a short time she was able to walk about the city without a truss or support of any kind in the femoral region.

CASE 6. In March, 1847, Mrs. K., a married lady of Grafton County, N. H., aged about forty-four years, consulted me in consequence of a large hernia in the left inguinal region which had existed for sixteen years; and also a small hernia of the right side which was becoming troublesome, though of only two years' standing. That of the left side had been irreducible, according to the patient's statement, for more than nine years, having caused her great suffering from time to time, disabling her from active exercise, and deranging her general health. She had been under the care of some of the most eminent surgeons in the State, but had obtained no relief, owing to the impossibility of returning the protrusion. Bandages and trusses with hollow pads had been almost constantly worn, to the great discomfort of the patient. Upon examining the tumor, I found it to be soft and quite elastic to the touch, strictly indicating the presence of the bowel. The sensations produced by pressure were very disagreeable to the patient, being referred directly to the bladder and also accompanied by nausea. The opening through which the hernia descended was above Poupart's ligament, and at first was quite difficult to determine with certainty on account of the great size and the spreading out of the protrusion beneath the superficial coverings. In this case I tried the taxis with great persever-

ance, but was unable to effect a reduction until I had performed a subcutaneous enlargement of the opening with a very delicate knife. The incision was extremely slight, and even with its aid the reduction was tedious and difficult, and was accompanied by the gurgling noise peculiar to the reduction of intestine. Afterwards the hernia on the other side was operated on in a similar manner with entire success. This operation was followed by treatment for a radical cure, and after only six weeks' residence in Boston, she returned to N. H. and soon after became able to walk about and without any necessity of wearing a truss. I have seen this patient many times since, and her infirmities have not recurred.

CASE 7. Mrs. H., aged thirty-eight years, and somewhat corpulent, came to me in May, 1847, with a very large inguinal hernia on the right side, and an irreducible femoral hernia on the left side. Her suffering, she informed me, had been very great, sometimes almost intolerable. On cutting down upon the tumor on the left side I found its contents to consist entirely of omentum. A portion of this, of the size of a hen's egg, I removed, and returned the remainder to the abdomen. I afterwards operated upon both sides successfully for a radical cure.

CASE 8. In July, 1847, Mrs. K., aged about forty-five years, of spare habit of body, came to me to consult about two inguinal herniæ. The one on the right side had been irreducible from three to four years. The protrusion was about the size of an English walnut. I found it impossible to reduce by the taxis, and therefore operated with the

knife. This was successful, and followed by no unpleasant consequences.

CASE 9. Mrs. H. was born in Scotland, aged thirty-seven years, and naturally of a delicate constitution. She was the mother of seven children. Shortly before the birth of her eldest child, she ruptured herself on the left side, by retching during seasickness while crossing the Irish Channel. Her other children were born in London, where she resided eleven years. Meanwhile the hernia had increased to an alarming extent and bid defiance to every method of retaining it, whether by trusses, bandages, or supporters, and frequently became so much incarcerated as to require eight or ten hours before relief could be afforded by her attending physicians. In 1841 she came to Boston. For about two years previous to March 20, 1847, where I first saw her, the hernia had made rapid progress, and interfered with the healthy functions of the bowels, kidney, and bladder.

April 1. I examined her and found on the left side a protrusion of great weight, which in the erect posture depended down the thigh to within six inches of the knee. It was, judging from external manipulation and from the symptoms, made up of a portion of the left descending colon, small intestine, bladder, omentum, etc., and of the size and shape of a child's head and neck (using her own words, "of a large child"), the neck occupying the left inguinal region. In the right inguinal space was also situated a smaller hernia of ten years' duration, the shape and size being that of a large pear. When the patient assumed the recumbent posture, both herniæ were reducible by the taxis with the exception

of a small omental mass on the left side about the size of a hen's egg, which the patient said had not been reduced for twelve years. The opening through the abdominal walls on the left side would admit freely the introduction of four fingers, and allow them to pass down behind the viscera upon the psoas muscle, and I could distinctly feel the pulsation of the external iliac artery. The opening on the right side, through which the smaller hernia descended, would admit two fingers. The operation I usually perform was proposed in this case with some encouragement of success. After a brief preparatory treatment, having returned to the abdomen all that could be reduced by the simple taxis, I operated subcutaneously in the presence of Dr. John Homans, Sen., and others, dividing cautiously the adhesions existing between the irreducible omental process and the thickened walls of the neck ; and finally performed the operation for radical cure.

May 3. I operated on the smaller hernia. The whole case was quite successful, resulting in the entire closure of the broken inguinal regions and subsequent restoration to health. Since the cure, the textures about the opening appear thickened and firm, and the healthy functions of the intestine and bladder have returned.

September 1. The patient remains in good health and free from rupture. In this case, on account of the large size of the openings, I advised the wearing of a common light truss as a measure of precaution.

CASE 10. Captain S., aged about forty years, came under my care in January, 1848, with an omental and intestinal

hernia which had become scrotal. The omentum had been irreducible for five years. I cut down upon and removed that portion of the omentum which was irreducible, having first ligated the mass at its neck. The patient recovered rapidly from the operation, and I shortly afterwards operated for the radical cure of this rupture.

CASE 11. In September, 1850, Mrs. S., aged fifty-five years, and quite fleshy, placed herself under my care with an irreducible inguinal hernia on the right side. The tumor was about the size of a hen's egg, and of long standing. It had been incarcerated with symptoms of partial strangulation for three months previously. There was considerable water in the sac, which I drew off with a trocar, and then succeeded in returning to the abdomen that portion of the protrusion which consisted of bowel. To return the omentum the operation as usually performed was necessary. This case I afterwards operated on for a radical cure.

CASE 12. Captain R., aged about fifty-five years, of spare habit of body, came to me in November, 1850, with an irreducible femoral hernia on the left side, of seven years' standing. I found, on cutting down, that it contained omentum only. Having been out of the abdominal cavity so long, it had become considerably enlarged and was for other reasons not fit to be returned. I therefore removed it with the knife, having previously ligated it tightly. No bleeding followed, and the patient soon recovered perfectly. No operation for radical cure was necessary in this case.

CASE 13. Mrs. B., aged about twenty-five years, consulted me in June, 1851, for an irreducible femoral hernia of thir-

teen years' standing. She had suffered much from attacks of colic at different times. I tried in vain to effect a reduction by taxis, and therefore resorted to the operation. I found very strong adhesions existing, which were broken up with much difficulty. I then succeeded in effecting a reduction, though not without some enlargement of the ring. No inconvenience was experienced from the operation, and the patient soon recovered.

CASE 14. Mr. C., aged about twenty-four years, came to me in the fall of 1851 with an irreducible omental hernia of recent occurrence. It was very painful, so much so that he had been unable to wear any kind of truss or supporter during most of the time, and had been unable to walk. The soreness was so great that I was unable to try the taxis to any great extent. I therefore cut down upon it, and returned it without being obliged to enlarge the ring. He recovered quickly without any unpleasant symptoms.

CASE 15. Miss V., of Salem, consulted me in December, 1851, for an irreducible femoral hernia of ten years' standing. She had, at intervals, been subject to attacks of partial strangulation, which had caused her great suffering. Protracted vomiting and retching, continuing sometimes for two or three days, accompanied these attacks. I endeavored persistently on several days to reduce the hernia by taxis, but without success. I finally concluded to resort to the operation, and on cutting down, found that the protrusion, contrary to what might have been expected, consisted of omentum. This was so much altered that I was obliged to remove it. She recovered perfectly, and I afterwards operated for a radical cure.

CASE 16. Miss S., aged thirty years, consulted me on July 10, 1852, for an irreducible femoral hernia. This I made prolonged efforts to reduce, but without success. Accordingly at her own request, I operated upon it, and, on cutting down, found the entire protrusion to consist of omentum. This I ligated and removed. A slight operation afterwards sufficed to effect a radical cure.

CASE 17. In July, 1852, Mr. P., of Providence, R. I., entered the Infirmary, afflicted with double hernia. That on the right side, an inguinal hernia, was reducible, and I operated on it successfully for a radical cure. On the left side was an omental inguinal hernia, which had been partially irreducible for eighteen years previously. Not being able to effect a reduction, I cut down, and found the return was prevented by extensive adhesions which I carefully removed. Owing to the altered condition of the omentum, I felt obliged to ligate and remove it. The wound healed after a few days, and a radical cure followed without further operation.

CASE 18. In February, 1855, Mr. I. B., of Boothbay, Me., applied to me with an irreducible inguinal hernia on the left side. Upon this I operated subcutaneously, and succeeded in reducing it, whereupon I operated for a radical cure. This hernia had been irreducible for twenty-four years.

CASE 19. In December, 1856, Mr. J., of Watertown, came to me with an irreducible inguinal hernia on the left side. I labored earnestly to return this protrusion at times for over a week. I then cut down and removed an irreducible mass of omentum. No bowel was present. A perfect recovery was made.

CASE 20. Miss I., about twenty-five years of age, came to me in June, 1863, from Enfield, N. H. She suffered from an irreducible femoral hernia. I cut down upon it with the knife, and then succeeded in returning it to the abdomen. I afterwards operated upon it for a radical cure, with successful result, and she returned to N. H.

CASE 21. Miss A., also of Enfield, N. H., came to me in July, 1863, with an irreducible femoral hernia on the right side. Upon this, as in the previous case, I was obliged to cut down, as the taxis was unsuccessful. I found the protrusion to consist entirely of omentum, which I excised. This case was followed by a radical cure.

CASE 22. In July, 1864, Miss P., of this city, applied to me to relieve her from an irreducible femoral hernia of moderate size. I cut down upon the tumor, which was wholly omental. I removed a portion only of the omentum and returned the remainder. This proceeding rendered necessary a further operation for the radical cure, which was successfully performed.

CASE 23. Mr. B., of Boston, applied to me in October, 1864, with an irreducible inguinal hernia on the right side of long standing. This hernia had been incarcerated for a long time, and was accompanied by attacks of nausea and vomiting which on several occasions had increased so as to endanger his life. I cut down upon the protrusion and found it to consist of omentum together with a small fold or knuckle of bowel, and was able to return both omentum and intestine to the abdomen. The case was followed by the operation for a radical cure.

CASE 24. In February, 1865, Mrs. C., of Buffalo, N. Y., about twenty-eight years of age, applied to me with a troublesome irreducible femoral hernia on the right side of five years' standing. It had frequently caused her much distress and pain accompanied by vomiting, which often confined her to the bed, and rendered her life miserable. February 4th, she entered the Infirmary. On cutting down upon the hernia, it was found to contain both bowel and omentum, as had been indicated by the symptoms. The adhesions which were the cause of the irreducibility of the hernia being then carefully dissected away, the bowel and the omentum were returned to the abdomen; and the old hernial sac, which was but loosely connected, was also returned into the abdomen. February 19th, an operation was performed for a radical cure, the patient meanwhile dwelling with friends in a neighboring city. This lady returned home cured of her rupture, and was rendered capable of much endurance, as she has been in the habit of making annual visits to Boston from that great distance.

CASE 25. In November, 1866, Mr. S., of Hartford, Conn., applied to me with an irreducible inguinal hernia on the left side of twenty years' standing. The patient was quite corpulent, and the hernia had troubled him very much. The taxis was tried in vain, and the contents of the protrusion, upon cutting down, proved to be colon. The adhesions which prevented reduction were dissected away, and the colon returned to the abdomen. The result was successful, and an operation for closure of the hernial opening, afterwards performed, enabled the patient to dispense with external support.

CASE 26. In February, 1867, Mr. M., of this city, applied to me with an irreducible congenital hernia on the right side. The protrusion consisted wholly of omentum, and had become irreducible after a sudden increase caused by being thrown from his horse at the Battle of Bull Run. The tumor occupied the scrotum and even extended somewhat over the femoral region. The usual operation was performed, the omentum returned to the abdomen, and two wire sutures were used to approximate the pillars of the ring. The recovery was perfect. The patient, however, was directed to wear a light truss.

CASE 27. In May, 1868, Mr. B., of Rockland, Me., came to me with an irreducible umbilical hernia of large size. The protrusion being omental, the tumor was cut down upon, dissected away, ligated, and the whole mass removed. Care was taken previously to the ligation to ensure the absence of any intestine. The operation was tedious and protracted. The result, however, was a success, and no after-operation for a radical cure was necessary.

The foregoing cases, taken from many others to illustrate the practice advocated in this chapter are of those in whom the operations dated far enough back to establish the permanency of the recovery, and whose subsequent history has been more or less under observation.

To show the safety and advantage of removing large masses, and of operating when complications

exist, the two following are given from more recent cases.

CASE 28. In February, 1876, Mr. G., of Providence, R. I., applied to me with an irreducible inguinal hernia of the right side. The patient was a strong healthy man, aged forty-eight, weighing about one hundred and seventy pounds. The hernia had been irreducible for seventeen years; was the source of considerable trouble, and was accompanied by painful dragging sensations. The tumor was somewhat larger than a pint bowl, and had a large soft thick neck closely embraced by the abdominal ring. Repeated and prolonged attempts at reduction by taxis having proved ineffectual, an operation with the knife was deemed advisable. The patient's assent having been obtained, the omentum was cut directly down upon by making, immediately below the external ring, an incision about two and a half inches long, through which the omentum was turned out. The mass was six or eight inches in length, and weighed when fresh about one and a half pounds. The testis was adherent to the omentum by a single artery, of medium size, which was twisted off. The portion of omentum lying in the inguinal canal was not, as is usual, condensed into a narrow neck, but was gathered together like a piece of puckered cloth, rendering it necessary to apply as many as nine ligatures. These ligatures were tied one after another; and, as each ligated portion of the omentum was cut away below, there occurred the only hemorrhage of any account, and this at once subsided.

The patient made a rapid and complete recovery, the ligatures coming away on the seventeenth day. At the present time (1877) no trace of a hernia is to be detected. No after-operation for radical cure was necessary.

CASE 29. In the summer of 1876, Miss K., of this city, applied for relief from an irreducible femoral hernia of the right side. The irreducible portion consisted of omentum, but the intestine also frequently became engaged in the sac, and caused her much trouble and fears of strangulation. It was accordingly deemed advisable to operate upon the tumor. Upon cutting down, the omentum was found to be enclosed in a very thick sac, fully a quarter of an inch in thickness, while the protruded mass itself was about the size of a pigeon's egg. Care having first been taken to observe that the neck contained no fold of intestine, the neck of the sac, as well as the neck of the omental mass, was transfixed by a double-threaded needle, and the entire tumor was ligated. The mass below the ligature was at once cut away. The fibrous edges of the hernial opening were then approximated and fastened together with a single suture of silver wire. The ligatures came away in fifteen days. Recovery was perfect.

CHAPTER IV.

THE TREATMENT OF RUPTURE BY THE TRUSS.

It is evident to any one who has taken the pains to investigate the subject, that the palliative treatment of hernia has suffered extremely from the neglect of surgeons. A patient with rupture is referred forthwith to the instrument makers with the intimation that there is little help for him beyond wearing a truss. But with regard to the proper description of truss, suited to the case in hand, the surgeon rarely gives any directions to the maker, who therefore applies such an instrument as he sees fit, often to the manifest detriment of the patient. The treatment of rupture by the truss has thus fallen largely into the hands of unprofessional men, mostly uneducated tradesmen, whose management is at best empirical. It is obviously necessary that before applying any truss an accurate diagnosis should be made. In many

cases this is very easy, in others more difficult, and requiring accurate anatomical knowledge. The patient may not have a hernia at all, and a truss is applied over a hydrocele of the cord or a varicocele. Ill-fitting trusses are applied, with pads unsuited to the hernial aperture, or with springs too strong or too weak. The patient, if dissatisfied, returns to the tradesman, who applies another truss with as little science as before.

Modern Trusses. The truss of to-day is the same in principle as that of twenty-five years ago. The real improvements have been chiefly in the direction of lightness and greater elegance. No contrivance has yet been invented to successfully supplant the steel spring girdle. This is because steel girdles alone can be made to exert continuously for a long time an equable amount of pressure, and adapt themselves to the varying shape of the abdomen. The so-called "elastic" truss, which has been so extensively advertised of late, substitutes an india-rubber elastic belt for the steel spring of an ordinary truss. The elasticity of this belt constantly diminishes, so that the apparatus must be buckled tighter and tighter after a few months, and in other respects is less durable

than a spring-truss. It also fails to retain many herniæ which are easily supported by an ordinary truss. Nevertheless many patients, especially those with small or incomplete ruptures, think it easier to be worn ; and it certainly has this advantage, that it can be kept on during the night when it is usual to lay aside a spring truss. Elastic trusses are therefore quite convenient in cases where, after the operation for cure, some continuous support is needed for an unusual length of time.

In selecting a truss, the most important points are, first, the efficient retention of the hernia ; second, that this end be accomplished with the least possible inconvenience to the patient. To secure efficient retention it is necessary for the pad to be suited to the special variety of rupture, and to be held in proper position by a spring, which accurately fits the patient's body, and possesses sufficient strength to support the protrusion. If the spring is too large or too stout, or the pad too thick or too hard, the retaining power of the truss may not be affected, but the discomfort of the patient is needlessly increased.

Pads. Nearly all pads have a more or less rounded form which diminishes the liability to

galling or change of position. The most popular shapes are the oval and the pyriform. Hard pads are made of polished cedar, ebony, vulcanite, or of some material coated with vulcanite. Soft pads are formed of a nucleus of cedar, cork, or some light, firm material covered with a few layers of chamois. Hard pads are more cleanly than the soft, which require to be frequently renewed or re-covered; nevertheless, the latter are more popular.

The prominence or thickest portion, which exists to a greater or less extent in all pads, serves to retain them more readily in proper position over the hernial opening, and thus allows the use of a weaker spring. But if this prominence is too strongly marked or carried to excess, as it is in many of the pseudo-named "radical cure" trusses which press into and dilate the hernial opening, the tendency is to cause an attenuation and absorption of the edges of the fibrous ring, and consequently a probable increase of the hernia. .

Springs. Springs are made much lighter than formerly, and are usually covered with either leather, vulcanite, or a patent material known as "celluloid." They are also fashioned so as to

uncoil to a greater extent when applied to the body, thus greatly increasing the power in proportion to the weight, and enabling the spring to adapt itself to every peculiarity of form or varying shape of the body. Some patients bear strong springs without complaint, others fret under the lightest and weakest French spring. It is essential for the greatest comfort of the patient that the spring should fit the body snugly, and the girdle should touch upon every part except over the spine, passing around the body just below the anterior superior spinous processes of the ilium.

Inguinal Trusses. In inguinal hernia the prominence of the pad should be quite slight, and be placed over the opening or external ring. The pad should shelve off suddenly below this, so as not to press upon the pubic bone at all. It should also shelve off slightly over the internal ring. An endless number of devices have been invented for the connection of the pad with the spring, of which the most noteworthy are the ball-and-socket joint, the sliding joint, the spiral spring, and the annealed neck. The simplest way of fastening the spring to the pad, and in many respects the best also, is

by merely screwing it on. The connection may also be made by means of a clamp of annealed metal (brass or iron) which is screwed on to both spring and pad. The surgeon who adjusts the truss is then enabled to make slight changes in the inclination of the pad by bending the annealed neck. The only advantage of sliding joints and other similar contrivances is to make a single truss capable of fitting several persons. But this is often a decided disadvantage to the patient, either on account of the pad slipping or working loose, or the probability that the patient will himself alter and misplace the pad. If a truss is once properly fitted, it thereafter needs no alteration, and any contrivance like the spiral spring, which allows the pad to tilt or move about, is objectionable in theory and in practice.

In inguinal hernia the pressure of the pad should be upwards and outwards from the median line. This effect is brought about partly by the peculiar curve of the spring when off the body, and partly also by wearing the truss in a proper position. The tendency in most cases is to wear the spring too low down over the back, so that the pad exerts too little upward pressure. Many herniæ require

a strong spring, especially if the opening is very free or the protrusion large. But it should be observed that in many cases where we are compelled to use a strong spring in order to retain the hernia efficiently, after a while we can substitute with advantage a truss with a much weaker spring, and yet support the protrusion perfectly.

In an inguinal truss the neck should be bent so that the longer axis of the pad may make an angle of about 45° with the line of the spring.

Femoral Trusses. A truss properly adapted to a femoral hernia should press directly backwards rather than upwards. Consequently, the spring may be placed lower down over the back than in a case of inguinal hernia. The spring should be shorter and relatively stiffer than in an inguinal truss, and the pad also should be narrower and smaller. The thickest or prominent part should be at the upper third of the pad, and should be placed directly below Poupart's ligament. The neck of the truss should be bent so that the axis of the pad shall be nearly at a right angle with the spring, as we are thus enabled to avoid much pressure upon the femoral vessels. This is a matter in which trusses, as commonly applied to fem-

oral hernia, are very frequently at fault. Nearly all trussmen, either willfully or from lack of diagnosis, apply to femoral hernia small-sized trusses made expressly for inguinal hernia. The long pads lie directly over the femoral vessels, and if the spring is strong enough to retain the hernia efficiently, the vessels are compressed, or if so weak as not to compress the vessels, it does not fully support the protrusion. Thus it is common to find people with femoral ruptures whose trusses are affording them but partial support, being worn with the hernia partly protruding, or occasionally wholly descended, and thus liable, of course, to contract adhesions and become irreducible, if not strangulated.

Umbilical Trusses. In umbilical hernia, a broad elastic belt is ordinarily substituted for the steel spring in the other forms of truss. The pad is oval or circular, with the prominence in the centre. It is often necessary, especially in corpulent people, for the prominence to be very strongly marked, so that it shall impinge upon the umbilical ring when pressed into the layers of fatty tissue, and thus be able to retain its proper position over the opening.

In the umbilical hernia of young children a truss is usually unnecessary ; but if one seems advisable, the light elastic kind will be best adapted for the purpose. Ordinarily a flannel bandage, with a thin, flat piece of lead or a bit of paste-board for a pad, nicely adjusted and properly attended to, will afford the requisite support.

There are found in the market many styles and patterns of trusses, known by various special names, which we have not the space to describe in these pages. I myself most frequently make use of the "Common Sense" truss, so-called, or of some modification of it. This truss is also exclusively used by the United States Government. The manufacturers, Messrs. Bartlett and Buttmann, have had their factory established in Boston for many years, and have always courteously extended to me the utmost possible facilities in procuring trusses suited for difficult cases.

The treatment of hernia by the truss will never be completely superseded by any process of radical cure, however perfect. A large percentage of those afflicted with hernia will always prefer to endure the discomfort and risks of a rupture rather

than submit to any operation, however mild its character, and a familiarity with the practical adjustment of trusses will consequently always be essential to any one who pays special attention to the treatment of hernia.

CHAPTER V.

VARICOCELE.

VARICOCELE (also called *cirsocele* or *spermatocele*) is a varix or enlargement of the veins of the spermatic cord. It rivals hernia in the frequency of its occurrence, but unless the varicose condition of the veins is considerable, the attending symptoms are so slight that the affection often escapes notice. It is met with in by far the greater number of cases on the left side only, and patients who are affected on the right side almost always suffer from an even greater enlargement on the left, or, in other words, have double varicocele.

Near the testicle the veins of the cord have numerous convolutions, sometimes called the "plexus pampiniformis." Higher up, this plexus is resolved into two veins, commonly uniting in a single trunk, which on the right side empties into

the lower vena cava, but on the left into the renal vein. The right spermatic vein is provided with a valve at its entrance into the vena cava, is shorter than that on the left side, and pursues a more direct course. The left spermatic vein is not only longer than the right, but passes behind the sigmoid flexure of the colon. The fact that the left testicle normally hangs slightly lower than the right, also adds to the necessary length of the cord of the left side. Moreover, the valve which strengthens the vein of the right side is commonly wanting on the left. These anatomical differences may serve partially to explain the extreme frequency of varicocele upon the left side only, but probably some physiological cause also obtains to a greater or less extent.

Varicocele presents a pyramidal tumor whose base is near the testicle and whose apex extends to the external abdominal ring. It is unusual for the veins to be much enlarged in the inguinal canal. The tumor has a convoluted knotted feel, often compared to "a bag of worms." In the recumbent position it disappears upon slight pressure, but returns when the erect posture is resumed; and this all the more quickly if, before

rising, the finger is placed upon the external abdominal ring, in this respect differing from a hernia, which would be retained by the pressure of the finger. It would seem to be a disease of easy diagnosis, yet it is remarkable how frequently it is mistaken for hernia. The details of the method of distinguishing between the two affections have been given under diagnosis of hernia.

A varicocele of moderate size does not usually cause much suffering or special disturbance. When much enlarged, however, it causes dragging pains and a sense of weight in the scrotum and testicles. Any varicocele is, also, generally subject to exacerbations, which are induced especially after protracted exertion, such as standing erect for a long time, horse-back riding, etc. At these times the tumor becomes much enlarged, and is attended by considerable pain, or even inflammation, and also by a marked depression of spirits. A large varicocele, after a while, always affects the testicle, gradually impairs its function, diminishes desire, and in many cases causes a perceptible softening and flaccidity of the organ, which finally atrophies and becomes smaller than its mate. It is true that this effect is not produced in all cases, but it is a common result.

Some surgeons treat varicocele by recommending the wearing of a truss. This is a very injudicious practice, as the pressure of a truss cannot but aggravate the varicose condition of the veins. In mild cases, in which no operation for cure is required, the best treatment is to support the scrotum in a suspensory bag or bandage. This should be made of some firm material, and not of the loose extensible network frequently employed in the manufactured article, as this soon stretches out and gives little real support. The left testicle, naturally slightly lower than the right, is much more so in an old varicocele. The bandage serves not only to support the testicle, but also, by removing the sense of weight, relieves the patient of the greater part of his pain.

For the radical cure of varicocele many operations have been proposed, most of which are of very considerable severity, invaliding the patient for an unnecessary period, or involving the employment of cumbersome and useless apparatus. The operation which I have practiced for many years past has been performed, as has my operation for the cure of hernia, in many hundreds of cases, and is of so trivial a character as to be at-

tended with but little pain at the time of operation, and but slight annoyance afterwards.

Operation. — The operation consists in ligations of the enlarged vein of the cord, in two or more places, by silver threads, through openings so minute that the ligatures may be said to be practically subcutaneous.

Having ordered the patient to stand erect, take the scrotum between the thumb and fingers, and find the spermatic cord. Then, by a little manipulation, separate the enlarged vein or veins, generally found lying in the front of the cord, from the other components of the cord itself. This separation is accomplished by moving or rolling the cord between the thumb and forefinger, and is to be made as near the testis as possible, as the first ligature should always be the lowest one. Keeping the varix thus separated, and firmly held between the thumb and forefinger, the patient is directed to lie down upon a lounge; and then, by a series of sliding motions, using the fingers of both hands, the varix, thus inclosed by the pressure of the fingers in a temporary compartment of the sheath of the cord, is confined also in a similar compartment of the scrotum. By successive

changes from the grasp of the thumb and forefinger of one hand to that of the other, the small fold of the scrotum, which lies over the inclosed varix, is then stretched to the utmost, and is finally left in the grip of the thumb and fingers of the left hand. A small incision, less than a quarter of an inch in length, is then carefully made in the fold of the scrotum directly over the vein, and longitudinal with it. Owing to the tension of the scrotal integument, the edges of the wound at once spread apart, showing the white sheath beneath. This is to be dissected through with great care, using the point of the scalpel. Its division reveals the inclosed vein, which is easily recognized by its characteristic and shining appearance. A stiff curved needle, made for the purpose, and carrying a silver wire, is then passed into the sheath beneath, and around the vein, elevating it slightly, and bringing it into full view. Care having first been taken to observe that nothing but the vein is embraced by the wire, the vein is then ligated, and the two ends of the wire cut off very close to the knot or twist. The patient is then directed to stand erect, the shaft of the needle still remaining under the vein, in order to retain it in position ;

while the surgeon, feeling the vein through the scrotum as before the first operation, follows it up by sliding his fingers along it, and brings another portion of the varix near to the scrotal surface an inch or so higher up than before. The operation of ligation as above detailed is then repeated through another little opening made in the scrotum; only, before fully tightening the ligature, the portion of vein lying between the two ligatures should be compressed so as to expel as much as possible of the contained blood. Also, while the patient is standing erect, the scrotum should be gently compressed so as to give exit to any blood that may have found lodgment therein. A third ligature, if need be, is then to be applied still higher up, and even a fourth in some extraordinary cases, though generally but two are necessary. When all that are considered advisable have been applied, the needles are to be withdrawn, and the ligated veins allowed to slip back into their natural position, with the ligatures attached. The wounds made in the scrotum at once become almost invisible, owing to the elasticity of the integument in that region, and to its distention when the incisions were made. The scrotum should then

be sponged with cold water, with sufficient compression to force out any remaining blood, and to astringe the dartos as much as possible. A stout suspensory bandage should then be applied, accurately fitting the scrotum, and keeping it well up towards the pubes.

In cases where the varicocele has become much developed, requiring several ligatures, the patient may be kept in bed for a day or two after operation, but ordinary cases need only a properly-fitted suspensory bandage, and a caution against too much exercise.

The needle used to introduce the silver wire is shown in Fig. 8. It is mounted in a light handle, B, and towards the point is flattened and widened by the addition of wedge-shaped shoulders, which have a dull cutting edge. This blade is also pierced by an eye, A, furnished with a slot to partly sink the thickness of the silver wire, and is slightly curved to facilitate its passage



FIG. 8. under the vein.

In tying the wire the ordinary square knot may be used if desired. The chief objection is that it is quite difficult to tie the second knot so that it shall lie close up to the first, and at best the result is an undesirable mass of wire. The better way is to use stout silver wire (Browne and Sharp's guage, No. 22), and after having tightened the first knot as much as possible, to swing the ends around so as to change the knot into a couple of loops or hooks.

The ends are then cut off very close to the knot, the points pressed down, and the shape of the hooks perfected by a small pair of pincers. By this device we escape any possibility of irritation which might be produced by ill-shaped and projecting ends. The coats of the veins are generally too thin and delicate to admit of twisting the ligature.

The pain attending the performance of this operation is but moderate, on account of the minuteness of the wounds and the complete isolation of the vein. Care always should be taken, before tightening the ligature, that it includes nothing but the vein, not only on account of the important organs that compose the remainder of the cord, but also because if any nervous filaments are included much more pain would be experienced.

There is usually no pain following this operation. The vein becomes swollen between the ligatured points, making a distinctly-marked tumor or tumors about the size of an almond. At first these bunches are tender to the touch; afterwards they harden, and gradually, though slowly, disappear. The suspensory bandage should be worn for at least a number of weeks afterwards. As the ligated veins slowly atrophy, there is usually considerable shortening and contraction, especially if the bandage affords efficient support, and is faithfully worn. The extreme dependency of the left testicle is thus remedied in a measure. If the scrotum has been much enlarged by the varicocele, it usually also contracts somewhat, especially if the patient can be induced to astringe it daily with cold water. It is, therefore, wholly unnecessary, as well as unwise, to attempt to excise any portion of it because of its apparent redundancy, as is recommended by some surgeons.

It is sometimes doubtful what becomes of the silver sutures. They occasionally disappear, or seem to get encysted,—at any rate they do not give any trouble whatever.

This successful treatment of varicocele is also

generally followed by considerable improvement in the functions as well as the physical condition of the testicle. The venous circulation of the cord cannot but be improved by the occlusion of the enlarged vein which previously crowded the sheath, and the testicle tends to participate in this benefit after a sufficient time has elapsed. Only when the organ is in a much atrophied and softened condition, following a bad case of varicocele of long standing, or in a patient advanced in years, do we fail to obtain this gratifying result.

CHAPTER VI.

HYDROCELE.

HYDROCELE is the accumulation of a fluid in the cavity of the tunica vaginalis. It is one of the most simple and easily-recognized diseases. The symptoms are a gradual swelling of the scrotum, usually on one side only, more commonly the left, accompanied by a sense of weight in the part. The tumor assumes a pyramidal shape, the base being below and the apex extending upwards along the spermatic cord, reaching in some cases as far as the external abdominal ring. Occasionally the shape of the tumor is altered by constrictions or adhesions of the sac which bind down the tunic. Fluctuation can almost always be detected on making pressure, and is the ordinary means of diagnosis. The contained fluid is commonly clear and straw-colored ; rarely dark-colored or cloudy, and then from previous inflammation. The scro-

tum, when distended with serum only, may be somewhat translucent. If, however, the fluid is opaque, or if the tunic or sac is much thickened, a condition which may obtain in old hydroceles, the light will be but faintly transmitted, if at all, and therefore this test is practically but little depended on.

The accumulation of the fluid does not usually cause any pain or special disturbance, except the inconvenience of weight and bulk. The tendency of the accumulation is to increase in amount; and the tumor, if neglected, may attain an enormous size. It is, therefore, customary to withdraw the fluid by tapping, when six or eight ounces have collected. The testicle and cord are generally found behind the mass of the fluid, or else buried in it; and in most cases can be readily made out.

Etiology. The causes of hydrocele are various, though in the majority of cases its origin is obscure. It may be due to a blow or other external violence to the testicle, or may be a sequel to enlargement of the testicle induced by specific disease. More commonly the disease comes on gradually, without assignable cause. In some cases, hydrocele is congenital. This happens when the

original communication is preserved which in the fœtus existed between the cavity of the abdomen and the tunica vaginalis. The effused fluid can then be forced up into the abdomen by continuous pressure, and it slowly returns when the compression is abandoned. Such cases are invariably accompanied by a tendency to the congenital form of hernia.

Common hydrocele, also, is liable to be complicated by the presence of hernia. In such a case it is possible, though rare, for the hydrocele to acquire an impulse on coughing, if in close proximity to the hernia. In all cases where hydrocele occurs conjointly with hernia, the hydrocele should always be radically treated, or at least the fluid should be withdrawn, before any operation for the cure of the hernia is attempted.

Treatment. The treatment of hydrocele is either palliative or curative. The palliative treatment consists in puncturing the tumor with a small trocar, and allowing the liquid to escape. In a very few cases, particularly those of young children, this may excite sufficient irritation to produce a permanent cure; but, in the great majority, in a few months the fluid again accumulates, and the tapping must be repeated.

The treatment for a radical cure consists in drawing off the effusion, as in the palliative method, and then introducing some irritating substance which shall destroy the excessive secreting power of the serous surface of the tunica vaginalis. It is not necessary that the inflammation should unite the opposing surfaces of the sac, though often this is the result to a greater or less extent. All that is required is that the production of the fluid shall be restricted.

Operation. The operation is as follows: Grasp the scrotum firmly from behind, and making it tense by pressure, quickly plunge in a trocar of moderate size directly in front of the tumor. As soon as the instrument has penetrated the tissues, take care to turn the point upward so as to avoid wounding the testicle, which is generally situated at the lower and back part of the cavity. Allow the fluid to escape, and then introduce the irritating medium employed through the canula of the trocar.

It is almost the universal practice, at present, to use the tincture of iodine, more or less diluted, for this purpose. But there are various objections to the use of iodine, of which, perhaps the most im-

portant, especially in reference to the surgeon's reputation, is that it often fails to produce the promised radical cure. Its injection, moreover, causes the patient great and immediate pain in the testicle, which is often excruciating, and to be avoided, if possible.

Again, the use of iodine is contra indicated whenever the hydrocele is accompanied by a diseased testicle; and, as this in practice is a complication frequently observed, the objection becomes a serious one. In such cases we must first treat and endeavor to cure the testicle before the operation to cure the hydrocele by iodine can be attempted. This involves tedious delay, and practically precludes the operation. For these reasons I have been led to abandon entirely the use of this objectionable agent, and have for many years made use of the powder of *red precipitate*. This powder readily adheres to a moistened probe, which can then be thrust through the canula several times, introducing a certain amount of the powder within the tunic. The irritation caused by this drug has, so far as my observation goes, almost invariably resulted in a radical cure. Besides, it is not, as is iodine, contra indicated by

the presence of an enlarged or tender testicle, but, on the contrary, often has a curative effect on such a condition of that organ, as well as on the diseased tunica vaginalis.

Ordinarily the immediate pain caused by this irritant is excessive, and it may be diminished by inserting through the canula, at the time of operation, a little sulphate of morphine. If, a day or two after operation, the fluid again accumulates, distending the scrotum, and there is considerable heat and swelling of the scrotal integument, cloths wet with alcohol and water may be applied. Generally, at the end of two weeks, absorption is assured, and the scrotum gradually resumes the natural size and condition.

In cases where the fluid, after operation, becomes very great in amount, its absorption may be accelerated by withdrawing a portion with the trocar. If the fluid thus withdrawn is not sufficiently cloudy or otherwise altered in appearance so as to indicate a curative progress, a little more of the red precipitate should be inserted. Usually, however, this is unnecessary.

The amount of red precipitate introduced in the operation for cure varies somewhat with the size

of the hydrocele and attending circumstances. In most cases, about two grains will suffice.

My attention was first called to the use of this drug in 1850, by Mr. Lloyd of St. Bartholomew's Hospital. In Holmes's "System of Surgery," Dr. Humphrey alludes to having tried this method of treatment in several instances, and to having desisted because he had caused salivation in two cases. I can only say that he must have used too large a quantity of the precipitate. But as such an effect, should it occur through lack of familiarity with the use of the drug, can easily be relieved by the chlorate of potash, and is itself of short duration, such a mishap ought not to militate against the agent in view of the extraordinary success attending its employment.

In treating hydrocele in infants and young children, the precipitate should not be used, being unnecessarily harsh, but some slightly irritating injection should be employed. The fluid extract of *Quercus Alba* answers the purpose very well. I also invariably make use of this extract in treating hydrocele of the cord in children and young adults. This disease is very commonly mistaken for inguinal hernia, which it much resembles in appear-

ance; and, as the contained fluid can in some cases be returned to the abdomen, the detection of fluctuation and the peculiar feel of the fluid may be the only means of diagnosis left. In treating such cases, a few drops only of the fluid extract are required to be injected.

APPENDIX.

CASES OF THE PERMANENT CURE OF HERNIA.

[THE following skeleton reports of cases have been taken from the many hundreds recorded in my journal. A more extended account seems unnecessary here, since the extreme similarity of the symptoms following these operations would render a minute history of individual cases as unimportant as it would be tedious to the reader. The operation and after-treatment have been already sufficiently described in Chap. II., and therefore need not be repeated. The publication, however, in brief, of a few of the large number of cases in which the operation by tendinous irritation has been successfully performed by me may assist in establishing the feasibility and safety of the method.

It will be observed that many of these cases now reported were of an unpromising type for successful operation, the herniæ being of large size or of unusually long standing, and not always those which would be chosen by a surgeon desiring to obtain an assured large percentage of cures. Some were complicated also with hydrocele, varicocele, and other

diseases which greatly increase the difficulty of the operation.

The cases published are known to be thoroughly cured, — sufficient time having now elapsed to establish that point beyond question. Though not a tithe of my permanent cures, they are enough for the present purpose.]

Mr. D., of Marlborough, Vt., aged twenty-two years, consulted me February 28, 1847, for a direct inguinal hernia of about one year's standing. The tumor was of great size and fully distended the scrotum. He had been unable to retain it with any truss, and had been obliged to abandon active business. February 28, the operation for cure was performed, and he remained under my care one week.

Mr. A., of Brookline, Mass., aged about forty years, suffered from a femoral hernia on the right side, of some ten years' standing. He also had an oblique inguinal hernia on the left side, and a varicocele on the same side. He had applied to the most celebrated practitioners in London and Paris in vain for relief. December 6, 1845, I operated upon the femoral hernia; in August, 1846, upon the inguinal hernia, and in March, 1847, upon the varicocele. This patient subsequently revisited his physicians in London, and allowed them to examine his case once more. The curious reader will find this case referred to at some length by Sir William Fergusson, surgeon to the Queen, in his "System of Practical Surgery," *English* edition, at the close of the chapter on Hernia.

Mr. C., of Fall River, Mass., aged thirty-five years, a

very fleshy man, had a very large oblique inguinal hernia on the right side, which he had been unable to keep up with a truss. May 15, 1847, operated upon.

Mr. B., of Boston, aged about twenty-four years, had oblique inguinal hernia of the right side, of about six years' standing. The opening through which the protrusion took place would readily admit three fingers. Operated upon May 20, 1847.

Mr. M., of Gloucester, Mass., aged twenty-seven years, consulted me for a hernia and varicocele, both on the left side, and of ten years' standing. The complaint gave him great trouble, making it often impossible for him to attend to his business. May 21, 1847, operated upon the hernia, and three days afterwards operated upon the varicocele.

Mr. A., of Prospect, Me., sea-faring man, was operated upon for an oblique inguinal hernia of six months' standing, in June, 1847. The hernia had attained the size of a large goose egg, and was with difficulty reducible.

Mr. P., of Providence, R. I., aged about fifty-four years, consulted me in July, 1847, for an inguinal hernia on the right side of sixteen years' standing. It was very large, and he had been unable to find any truss that would retain it. Consequently it had been allowed to remain constantly down for several years. After a few days of preparatory treatment I operated for its radical cure on July 10th.

Mr. D., of Boston, aged twenty-six years, had suffered much for several years from double inguinal hernia. Although he had worn a strong double truss, he had often found it ineffectual to retain the protrusions. One of the

ruptures had several times become partially strangulated, endangering his life, and causing excessive pain. I operated upon both sides on July 28, 1847. He remained under my care for two weeks.

Mr. H., of Bridgewater, Mass., aged about thirty-five years, had been troubled for several years past with an oblique inguinal hernia on the right side, complicated with hydrocele of the spermatic cord. He came under my care in November, 1847, and remained about two weeks. Before operation the hernia caused him a great deal of pain whenever it was allowed to descend.

Mr. H., of Boston, aged about twenty-eight years, had been troubled from boyhood with oblique inguinal hernia on the right side. He remained under my care for about a week after the operation, which was performed March 31, 1848.

Mr. B., of Concord, Mass., consulted me in January, for an oblique inguinal hernia on the right side, and a femoral hernia on the same side, the latter being of unusual size. They were of four years' standing, had descended freely, and he was unable to prevent the descent with a truss. Much of the time he had been unable to work with any comfort. January 20, operated upon both herniæ.

Mr. J. S., Valley Falls, R. I., came to me with an inguinal hernia on the left side, of fourteen years' standing. It had for a long time caused him great pain in the back and loins. Complicating the hernia was a small hydrocele on the same side, and also a varicocele on the left side. His general health was much impaired. October 5, 1847, operated for

the cure of the hernia, and a few days afterwards for the cure of the hydrocele and varicocele. Patient remained at the Infirmary three weeks. The cure of his complaints was followed by a great improvement in health.

Mr. H., of Essex, Mass., aged eighteen years, was ruptured, and otherwise badly injured by a fall from the cars. Following the hernia, varicocele appeared on the left side. March 10, 1848, operated upon the hernia, and a few days afterwards upon the varicocele.

Mr. G., of Boston, consulted me for an oblique inguinal hernia of the right side, of large size. The hernial opening was very large, so that a truss would not readily retain the protrusion, which caused him much inconvenience. Operated for its cure March 6, 1848.

Mr. J., of South Boston, aged forty years, had an inguinal hernia on the left side, of two years' standing. The opening was very large, and the protrusion could not be retained by the truss, but descended freely into the scrotum. The operation was performed March 18, 1848.

Mr. W., of Boston, aged twenty-seven years, had an inguinal hernia on the right side, of two years' standing. The hernial opening was large, and the hernia not retainable with the truss. March 24, 1848, operated for a cure.

Mr. W., of New Orleans, thirty-five years of age, came to the Infirmary with an oblique inguinal hernia on the left side, accompanied with a varicocele on the same side. Both complaints were operated upon in July, 1848.

Master E., of Charlestown, Mass., nine years old, had a direct inguinal hernia of five years' standing. The trusses

applied did not retain the hernia properly, and it was rapidly increasing in size. The operation took place on January 4, 1849.

Mr. A., of Essex, Mass., aged sixty-one years, had an oblique inguinal hernia on the right side, of five or six years' standing. In February, 1849, operated upon this hernia.

Mr. W., of Brookline, Mass., aged sixty-eight years, consulted me for an oblique inguinal hernia on the right side, of five years' standing. He had found it impossible to retain with the truss. In May, 1849, operated for its cure.

Mr. A., of Fall River, Mass., aged about twenty-seven years, had an oblique inguinal hernia on the right side, of several years' standing; also a varicocele on the left side. May 14, 1850, operated upon the hernia; May 31, upon the varicocele.

Mr. F., of Boston, about thirty years of age, came to me in June, 1849, with a very large direct hernia, on the right side, which he had never been able to keep up with a truss. The usual operation was performed.

Mr. F., of Portsmouth, N. H., aged about twenty-three years, had a very large direct hernia on the right side, and also a well-developed varicocele on the left side. June 14, 1850, operated upon the hernia, and within a week thereafter upon the varicocele.

Mr. B., of Jamaica Plains, Mass., about twenty-two years of age, had a large inguinal hernia on the right side, which for several years he had been unable to retain with a truss. September 9, 1850, operated for cure.

Mr. K., of Kennebunk, Me., aged about twenty-seven

years, and very fleshy, had a large direct inguinal hernia on the right side, of long standing, which he had been unable to retain with a truss. October 22, 1850, operated.

Mr. M., of Fall River, Mass., aged about forty-six years, had an oblique inguinal hernia, in size equal to a hen's egg. It was of several years' standing, and could not be kept up with a truss. In November, 1850, operated upon.

Mr. S., of Salem, Mass., aged fifty-five years, and very corpulent, had two large inguinal ruptures, which would descend in spite of the strongest truss. December 9, 1850, operated on both for a cure.

Mr. P., of Salem, Mass., aged about thirty-seven years, had for many years suffered from a direct inguinal hernia on the left side, accompanied by hydrocele. In December, 1850, both complaints were operated on at the Infirmary.

Mr. S., of Boston, aged sixty years, suffered from a large oblique inguinal hernia on the right side, of many years' standing. December 19, 1851, operated upon. This patient was directed to continue the use of a light truss.

Mr. M., of Swansey, aged thirty-nine years, had a large direct inguinal hernia on the left side, of fourteen years' standing. The operation was performed in January, 1851, and on account of the size of the opening required repetition.

Capt. T., of Salem, Mass., aged thirty-seven years, came to me January 17, 1851, with a direct inguinal hernia on the right side, complicated with hydrocele of long standing. The hydrocele was operated upon for a radical cure, and afterwards the usual operation was performed for the cure of the hernia.

Mr. H., of South Boston, about sixty years of age, came to me with an oblique inguinal hernia on the left side, of fourteen years' standing. The hernia could not be retained by the truss. Operated upon January 21, 1851.

Mr. M., of Bangor, Me., came to me in February, 1851, with a congenital hernia on the left side. The testicle, as usual in such cases, had only partially descended. It was, however, readily retained below the crest of the pubis by a compress, and the hernial opening was then closed by operation.

Mr. G., of Fall River, Mass., aged fifty-five years, put himself under my care in February, 1851, with a direct inguinal hernia on the left side, of ten years' standing, about the size of a hen's egg. The opening was very large, and in consequence he was advised to wear a light truss for a long period after the operation.

Mr. P., from Philadelphia, about thirty-five years old, applied to me in March, 1851, with a congenital hernia on the left side, of thirty years' standing. The hernial opening was quite large, and the testicle was drawn up. It was brought down and secured with some trouble, and the operation performed.

Mr. C., of Fall River, Mass., aged thirty years, came to me May 12, 1851, with a femoral and an inguinal hernia, both on the right side, and of five or six years' standing. These herniæ were caused by a bad cough. The time occupied in their cure was three weeks.

Mr. A., of Fall River, Mass., aged thirty-four years, applied to me in May, 1851, for the cure of a direct inguinal

hernia of seventeen years' standing, and about the size of a large goose egg. In this case there were several repetitions of the operation.

Capt. N., of South Boston, aged fifty-three years, consulted me for a double inguinal hernia. The protrusion on the right side was of two years' standing, and about the size of a hen's egg. That on the left was small and of recent date. I operated for the cure of both sides May 24, 1851.

Capt. G., of Winthrop, Me., applied to me for the cure of an irreducible direct hernia on the right side. Labored for three days, in various sittings, to reduce this protrusion by the taxis, and finally succeeded, and operated for cure on the following day, August 29, 1851. This patient was also afterwards cured of a fistula in ano.

Mr. B., of Worcester, Mass., aged twenty-three years, consulted me for a direct inguinal hernia, of eight years' standing, and produced by over-exertion in lifting. He applied a truss, which kept up the protrusion quite well until recently, when, owing to an enlargement of the hernial opening, the hernia became retainable with difficulty. Operated for cure, October 22, 1851.

Mr. W., of Boston, aged thirty years, applied to me for relief from an oblique inguinal hernia on the left side, complicated with hydrocele on the same side. The hernia was of four years' standing, and was caused by lifting. October 25, 1851, operated upon the hydrocele; and November 5, upon the hernia.

Mr. H., of Millbury, N. H., aged sixty years, consulted me for a direct inguinal hernia on the right side, of twenty-

five years' standing, and caused by a blow. In consequence of the injury, the cord was also enlarged, and for three or four years previously he had been unable to retain the protrusion with a truss. This case was operated upon March 16, 1852.

The Rev. Mr. T., of N. Y., aged sixty years, came to me in April, 1852, with an umbilical hernia of ten years' standing. The tumor was about the size of an English walnut. He had worn a stiff truss, and suffered much pain in the umbilical region. The usual operation was performed.

Mr. P., of New York City, aged seventy-three years, consulted me for a direct inguinal hernia on the left side, of ten years' standing. The hernial opening was large, and he was not able to retain the rupture with the truss. The usual operation was performed June 1, 1852, but on account of his age and the size of the aperture, the patient was directed to continue to wear a light truss.

Mr. B., of Boston, a very fleshy Scotchman about fifty years old, consulted me for a direct inguinal hernia on the right side, of about twenty-five years' standing. The tumor was about the size of a pint cup, and had been irreducible for about twenty years. I manipulated this hernia in several sittings, and on the second day succeeded in reducing it by the simple taxis. The patient had been subject previously to frequent attacks of partial strangulation. In November, 1852, operated for its radical cure. The patient in this case continued to wear a truss.

Mr. B., of New Berlin, aged forty years, consulted me for double inguinal hernia, of thirty years' standing, that on

the left side accompanied by varicocele. He was a large, spare man, with thin muscles and large inguinal rings. All these affections were operated on in October, 1852.

Mr. K., of Boston, about twenty-five years of age, applied to me in May, 1853, for relief from a congenital hernia on the right side, which had existed from birth. The tumor was about the size of a goose egg. The testicle had only partially descended. I was, however, able to detain it below the pubes until the operation had effected a closure of the hernial opening.

Mr. W., of Somerville, Mass., aged forty-two years, consulted me for a direct inguinal hernia on the right side, of twelve years' standing. There was also a hydrocele of the tunica vaginalis, and an enlargement of the testicle on the same side. June 1, 1853, operated upon the hydrocele for a radical cure; and in July operated upon the hernia.

Mr. B., of New York City, placed his son, a child of seven years, under my care, with a right inguinal hernia which had existed since birth. July 16, 1853, operated for its cure.

Mrs. S., of Boston, about forty-five years old, and very fleshy, consulted me for a large umbilical hernia of many years' standing. For three years previously, it had been irreducible. August 2, 1853, operated for its reduction by subcutaneous dissection of the edges of the umbilical ring. This was followed by trials of the taxis in several sittings, and on the third day succeeded in reducing the protrusion. Afterwards operated for a radical cure.

Mr. L., from Maine, aged sixty-five years, consulted me for a direct inguinal hernia on the right side, with the bowel

descending freely into the scrotum, and also a very large hydrocele on the left side. In September, 1853, operated for the radical cure of the hydrocele, and in the following month cured the hernia.

Mr. W., of Dighton, aged fifty-five years, consulted me for double inguinal hernia, complicated with hydrocele of the tunica vaginalis on the left side. The cure of the three maladies occupied four weeks.

Mr. H., of Trinidad, aged fifty-four years, consulted me for a direct inguinal hernia on the left side. In this case there existed an enlarged spermatic cord and testis on the same side. The operation took place April 11, 1854.

Mr. C., of Lexington, Mass., applied to me for the cure of a femoral hernia on the right side. He had been unable to retain it with a truss. Operated on May 2, 1854.

Mr. P., of Malden, Mass., placed under my charge his child, two years of age, with a direct inguinal hernia on the left side, which it had been impossible to retain with the truss. Operated on May 15, 1854.

Mr. J., of New Bedford, Mass., aged sixty-five years, consulted me for double inguinal hernia, of thirty years' standing on the left side, and two years' standing on the right side. That on the left side he was unab'le to retain with the truss, and it was quite large. There was also a co-existent hydrocele on the left side. All three affections were operated on in June and July, 1854.

Mr. S., of Dedham, Mass., put under my care his little boy, two years old, with double inguinal hernia. That on the right was large, and of the congenital variety, while the

hernia on the left side was smaller, and of recent date. Operated on both sides, under ether, on June 12, 1854.

Mr. K., of Brighton, Mass., thirty years old, consulted me for a very large direct inguinal hernia, on the right side, of seven years' standing, and irreducible up to the time of his admission to the Infirmary. After several sittings, however, the protrusion was reduced by the taxis, and operated upon January 10, 1855.

Mr. S., of Providence, R. I., consulted me for double inguinal hernia — on the left side, of three years' standing, on the right side, of but one. Both herniæ were operated on February 26, 1855.

Mr. H., of Peacham, Vt., consulted me for an inguinal hernia, on the left side, accompanied by a varicocele on the same side. Both affections were operated upon in June, 1855.

Mr. G., of New York, placed under my care his young child with an umbilical hernia of considerable size, and with a large hernial opening. Operated upon in January, 1856.

Mr. B., of New York, aged thirty-five years, consulted me for a direct inguinal hernia, on the right side, of twelve years' standing, which he was unable to retain with any truss. He also had an umbilical hernia, which was very painful on account of a portion of it being irreducible. After various sittings, for four days, this protrusion was finally reduced by the taxis, and both herniæ were then operated on for cure in February, 1856.

Mr. P., of Charlestown, Mass., consulted me for a femoral hernia, on the right side, of some five years' standing. Operated upon in April, 1856.

Mr. D., of Cambridge, placed under my care his boy, five years of age, with an oblique inguinal hernia of three years' standing. Operated upon May 14, 1856.

Mr. H., of Bridgewater, Mass., placed under my care his son, twelve years old, with a congenital umbilical hernia, of small size. Operated upon September 24, 1856.

Mr. G., of Ware, N. Y., aged fifty-six years, consulted me for a direct inguinal hernia, on the right side, of four years' standing, and about the size of an egg. He had been unable to retain the protrusion with the truss. Operated upon November 27, 1856.

Mrs. W., of Boston, put herself under my care for an inguinal hernia, on the right side, of several years' standing. The hernia was operated upon in March, 1857.

Mrs. D., of North Hampton, N. H., aged thirty years, consulted me for a femoral hernia, on the right side, of three years' standing, and small size. Operated upon in July, 1857.

Mr. S., of Halifax, aged twenty-five years, consulted me for a direct inguinal hernia, on the left side, of moderate size, and quite recent. Operated upon in April, 1857.

Mr. A., of Providence, R. I., about forty years old, came to me with a femoral hernia on the right side, upon which I operated May 4, 1858. I afterwards operated upon his daughter for a small umbilical hernia.

Mr. H., of Mobile, Ala., aged fifty years, came to me with a direct inguinal hernia, on the right side, of large size, and free hernial opening. Operated upon August 25, 1858. This patient was directed to wear a light truss afterwards.

Mr. A., of Fall River, Mass., about fifty years of age, consulted me for double inguinal hernia, oblique on both sides, that on the right side of ten years' standing. Operated on both sides October 19, 1858.

Mr. P., of New Bedford, Mass., about fifty years of age, consulted me for double inguinal hernia, direct on both sides, and of over ten years' standing. In consequence of the large size of the hernial openings, he was directed to continue the use of a light truss. Both sides were operated upon December 14, 1858.

Mr. A., of Plymouth, Mass., aged forty-eight years, consulted me for an oblique inguinal hernia, on the left side, of several years' standing. There also existed a considerable degree of varicocele on the same side. Both affections were operated upon in December, 1858.

Mr. B., of Norwichtown, Conn., aged fifty-eight years, consulted me for an oblique inguinal hernia, on the right side, of long standing. Operated upon December 31, 1858.

Dr. H., of New York, aged fifty years, consulted me for an oblique inguinal hernia, on the right side, of many years' standing, and quite troublesome. Operated upon January 19, 1859.

Mr. W., of Stowe, Mass., a man weighing some two hundred and sixty pounds, applied to me for the cure of an inguinal hernia, of sixteen years' standing, and of very large size. Operated upon February 1, 1860.

Mrs. McC., from Vermont, consulted me for an irreducible umbilical hernia, of large size, and of sixteen years' standing. The patient was a very fleshy woman, about forty years old. After trial for several days, in various sittings,

I succeeded in reducing the whole of the protrusion by taxis, and on February 8, 1860, operated for a cure.

Mr. C., of Boston, aged forty years, consulted me for an oblique inguinal hernia, of large size, on the left side, and a femoral hernia on the right side, which had been irreducible for several years. This hernia, like the preceding, I succeeded in reducing by the taxis, and in March, 1860, operated upon both sides for a cure.

Mr. S., of San Francisco, Cal., aged forty-five years, consulted me for a direct inguinal hernia. He had previously visited Professor Wood, of London, and been operated on by him twice unsuccessfully. May 20, 1860, I performed my usual operation upon him, and with entire success.

Mr. D., of Pawtucket, R. I., aged twenty-two years, consulted me for a congenital hernia on the left side, with the usual complication of partly descended testis. January 25, 1860, operated upon the hernia.

Mr. F., of Hopkinton, Mass., aged twenty-seven years, consulted me for double inguinal hernia, both sides quite large, and constantly down, as he had not worn any truss. January 24, 1861, operated on both sides.

Mr. T., of Biddeford, Me., aged thirty-five years, consulted me for an irreducible inguinal hernia on the left side, of large size, and long standing. I succeeded in reducing the entire mass, and operated for cure on January 23, 1861.

Mr. W., of Ipswich, N. H., aged thirty-nine years, consulted me for a direct inguinal hernia on the left side, of large size, which descended freely into the scrotum. It also was complicated by varicocele on the same side. Both affections were operated upon February 13, 1861.

Mr. H., of Salem, Mass., aged forty-eight years, consulted me for a direct inguinal hernia on the left side, of very large size, filling the scrotum, and irreducible for several years previously. Succeeded in reducing by the taxis, and then operated for cure on September 24, 1861.

Mrs. F., of Putnam Corner, applied to me for relief from a femoral hernia on the right side, of small size. Operated October 15, 1861.

Mr. F., of Danvers, aged thirty-five years, consulted me for a femoral hernia, on the right side, of small size, and an oblique inguinal hernia on the left side, of long standing. In May, 1861, operated upon both sides.

Mr. C., of Calais, Me., placed under my care his boy, eighteen months old, with an inguinal hernia on the right side. The hernial opening was large, and the abdominal walls quite thin. Operated, November 6, 1861.

Mrs. D., of Cambridge, Mass., aged forty years, consulted me for an inguinal hernia on the left side, which she had been unable to retain with the truss, and in consequence suffered from frequent attacks of partial strangulation. Operated August 20, 1862.

Mr. K., of South Boston, thirty years old, applied to me with a femoral hernia on the left side. He was quite fleshy, and the protrusion was evidently omental. Operated upon, October 24, 1862.

Mr. D., of Blackstone, Mass., consulted me for double inguinal hernia, that on the right side quite large, and of seven years' standing, that on the left side small and of recent origin. In November, 1862, operated upon both sides.

Mr. C., from Cuba, placed under my care his son, aged fourteen years, with double femoral hernia, of three years' standing. Operated upon both herniæ in June, 1863.

Miss M., of New Bedford, about twenty-five years old, consulted me for a small omental femoral hernia, which had lately become very difficult to reduce. Operated November 26, 1863.

Mr. L., of Fremont, Me., about forty years old, consulted me for an oblique inguinal hernia, and also a hydrocele of the tunica vaginalis on the left side. I first operated for the radical cure of the hydrocele, and in December, 1863, for the cure of the hernia.

Miss J., of Boston, consulted me for an umbilical hernia of long standing. Considerable difficulty was experienced in freeing the edges of the hernial opening, which was quite sensitive. The operation for cure was performed April 14, 1864.

Mr. W., of St. Stevens, Me., aged about thirty years, consulted me for an oblique inguinal hernia on the left side, accompanied by a varicocele on the same side. Both affections were operated on in May, 1864.

Mr. C., of Oshkosh, Wis., about forty years old, consulted me for an oblique inguinal hernia on the right side, and a hydrocele on the left side, of considerable size. Both affections were operated upon in July and August, 1864.

Mr. McD., of Thomaston, Me., about forty years of age, applied to me in April, 1864, with a femoral hernia on the left side, of small size, and an oblique inguinal hernia on the right side. There was also incipient double hydrocele of the tunica vaginalis. Both herniæ were operated upon.

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Mr. W., of New York, fifty years of age, consulted me for double inguinal hernia, that on the right side very large, and of thirty years' standing. Both herniæ were operated on in June, 1865. The openings were very large, and the patient a very fleshy man. Consequently he was directed to continue the use of a light truss after the operations.

Mr. R., of Waldoborough, Me., about forty-five years of age, consulted me in March, 1865, for an oblique inguinal hernia of the right side, of only a few weeks' standing. This patient had been, years previously, cured by me of an oblique hernia on the left side, of long standing.

Mr. P., of Waltham, Mass., aged nineteen years, consulted me for a direct inguinal hernia on the right side, of seven or eight years' standing. The protrusion was quite extensive, and he was unable to retain it with trusses of the best pattern, and was wearing the truss with the hernia descended. Operated June 18, 1865.

Mrs. S., of Boston, consulted me for an irreducible femoral hernia on the left side, which had not been returned to the abdomen for seven years. After considerable manipulation I succeeded in reducing the tumor, which was apparently omental, and operated for a cure on June 18, 1865.

Major S., of Chicago, Ill., aged about twenty-five years, consulted me for double direct inguinal hernia, of two years' standing, caused by cavalry service during the war. Operated upon both sides October 21, 1865.

Mr. N., of Roxbury, Mass., aged thirty-seven years, consulted me for a direct inguinal hernia on the right side,

of several years' standing, which he found difficulty in retaining with the truss. Operated upon October 26, 1865.

Mr. G., from Canada, aged twenty-eight years, consulted me for a congenital inguinal hernia on the right side. The testicle was small, and had not descended into the scrotum. Operated May 28, 1866.

Mr. V., of Rochester, N. Y., aged thirty-five years, consulted me for an oblique inguinal hernia on the right side. The tumor was of small size and recent origin. Operated July 28, 1866.

Mr. R., of Newburyport, Mass., aged forty-five years, consulted me for an oblique inguinal hernia on the right side, of over thirty years' standing, caused originally by a strain. Operated upon April 15, 1867.

Mr. H., of Concord, Mass., aged fifty-five years, consulted me for a direct inguinal hernia on the right side, and of long standing. Operated upon in April, 1867. Afterwards (July 18, 1867) operated upon an oblique inguinal hernia on the left side, of quite recent standing.

Mr. H., of Providence, R. I., consulted me for a direct inguinal hernia on the left side, of eight or ten years' standing. He had been in the habit of going about without a truss, with the hernia protruding in a tumor about the size of the fist. Operated upon July 20, 1867.

Mr. S., of Roxbury, twenty-seven years old, consulted me for an oblique inguinal hernia on the right side, which had existed from boyhood. Operated on December 18, 1867.

Mr. P., of Charlestown, Mass., thirty-five years of age, and of quite stout person, consulted me for a direct inguinal

hernia on the right side, of twenty years' standing, and somewhat larger than an egg. It was very liable to slip down behind the truss-pad, and caused him much annoyance. Operated on January 2, 1868.

Mr. M., of Boston, twenty-four years of age, consulted me for a congenital inguinal hernia on the right side, of moderate size. As usual, the testis had but partly descended, but it could be successfully retained below the os pubis, and the hernia was operated upon February 10, 1868.

Miss H., of South Boston, about thirty years old, consulted me for an omental femoral hernia on the right side, of small size, and several years' standing. Operated upon in June, 1868.

Mr. Y., of Boston, placed under my care his child nine years of age, with an oblique inguinal hernia on the right side, together with hydrocele of the tunica vaginalis. Both affections were operated on in June, 1868.

Mrs. W., of South Boston, about thirty-five years old, consulted me for an umbilical hernia, of moderate size and recent standing. There was considerable difficulty experienced in freeing the edges of the opening, which was quite tender to the touch. Operated for a cure June 22, 1868.

Mr. T., of Wiscasset, Me., about forty years old, consulted me for a direct inguinal hernia on the right side, of large size, and five years' standing. Operated on January 10, 1869.

Mr. G., of Kennebunk, Me., sixty years of age, came to me with double inguinal hernia, both of large size, and about

twenty-five years' standing. Both sides were operated upon in March, 1869.

Mr. A., of Providence, R. I., twenty-two years of age, consulted me for congenital inguinal hernia on the right side, of large size, with the testis about half way down in the scrotum. Operated upon in January, 1870.

Mr. R., of Boston, about forty-five years of age, consulted me for double inguinal hernia, complicated on the left side with hydrocele. In June, 1871, operated upon the three affections.

Mr. L., of Attleborough, Mass., about forty-six years of age, consulted me for an oblique inguinal hernia on the right side, of recent occurrence. Operated October 20, 1870.

Mr. B., of Cambridge, Mass., placed under my care his son, about fifteen years old, with an oblique inguinal hernia on the right side, of moderate size. Operated upon in January, 1870.

Mr. S., of Dorchester, forty-eight years old, consulted me for an oblique inguinal hernia on the right side, of three years' standing, with a small hernial opening. Operated on January 10, 1870.

Mr. C., of Hudson, Mass., about thirty-five years old, consulted me for an oblique inguinal hernia on the left side, complicated with varicocele. Both affections were operated upon in February, 1871.

Mr. S., of South Boston, about twenty-five years of age, consulted me for an oblique inguinal hernia on the right side, of four years' standing. Operated upon March 1, 1871.

Mr. W., of Providence, R. I., aged forty-nine years,

consulted me for double inguinal hernia, of several years' standing, that on the left side of small size. Operated on both sides in May, 1871.

Mr. R., of Lawrence, Mass., thirty-five years old, consulted me for an oblique inguinal hernia on the right side. In June, 1872, operated.

Mr. B., of Newton, Mass., about sixty years old, consulted me for an oblique inguinal hernia on the right side, of large size, and with a free opening. The patient was quite fleshy. Operated on in September, 1872. A light truss was directed to be worn afterwards in this case.

Mr. C., of Boston, about thirty-five years old, applied to me with a femoral hernia on the right side, of small size. Operated on in January, 1873.

Mr. T., of Portland, Me., placed under my care his boy, ten years old, with an oblique inguinal hernia on the left side, and a hydrocele on the same side. In May, 1873, these affections were operated upon, requiring three weeks for the cure of both.

Mr. F., of Boston, aged forty-nine years, consulted me for an oblique inguinal hernia on the right side, of large size. It was apparently irreducible at first, but was finally reduced, on the third attempt, with the taxis. Operated upon this hernia in August, 1874.

Mr. B., of Joliet, Ill., aged forty years, consulted me for a double inguinal hernia, of five years' standing; that on the right side of considerable size. Operated in October, 1873.

Mr. G., of Newton, Mass., placed under my care his son, fifteen years of age, with an oblique inguinal hernia on the left side. Operated in September, 1874.

Mr. T., of Brooklyn, N. Y., an elderly man, consulted me for an oblique inguinal hernia on the right side. Operated upon in September, 1874.

Mr. D., of Calais, Me., about fourteen years of age, consulted me for a congenital hernia on the left side, with the usual mal-position of the testis. Much difficulty was experienced in confining this organ by the compress. Operation was performed in October, 1875.

Mr. G. W., of St. Johnsville, Vt., thirty years old, consulted me for a small oblique inguinal herpia on the left side, complicated with varicocele on the same side. In November, 1875, the hernia was operated upon, and in the following week the varicocele also. There was some difficulty in the performance of the latter operation, on account of the unusual shortness of the cord.

Mr. H., of Lee, Me., placed under my care his little boy, eighteen months old, with an oblique inguinal hernia on the right side, of six months' standing. The tumor was about the size of an English walnut. Operated upon April 17, 1876.

Miss B., of Providence, R. I., about thirty years of age, consulted me for a femoral hernia on the right side, of three years' standing, and about the size of a walnut. The tumor was evidently omental, and had been irreducible for two years previously. I succeeded, nevertheless, in reducing it by the simple taxis at the second sitting, and operated for cure in April, 1876.

Mr. A., of N. New Castle, Me., about forty-eight years old, consulted me for an irreducible umbilical hernia, o

three years' standing, about the size of a hen's egg; also for a varicocele on the left side, very large, distending the scrotum, which was very dependent; and also for an oblique inguinal hernia on the right side, of twenty years' standing, and about the size of a goose egg. After considerable manipulation, extended through several days in sittings of a half an hour each, I succeeded in reducing the umbilical hernia. I then operated for the cure of all three affections in June, 1876.

Mr. Y., of Dedham, thirty-three years of age, consulted me for a varicocele on the left side, of several years' standing, which had caused him considerable annoyance. Operated on June 28, 1876.

Master C., of Brookline, Mass., a boy four years of age, was placed under my care with an oblique inguinal hernia on the right side, of three years' standing, and which was rapidly increasing in size. Operated on September 12, 1876.



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